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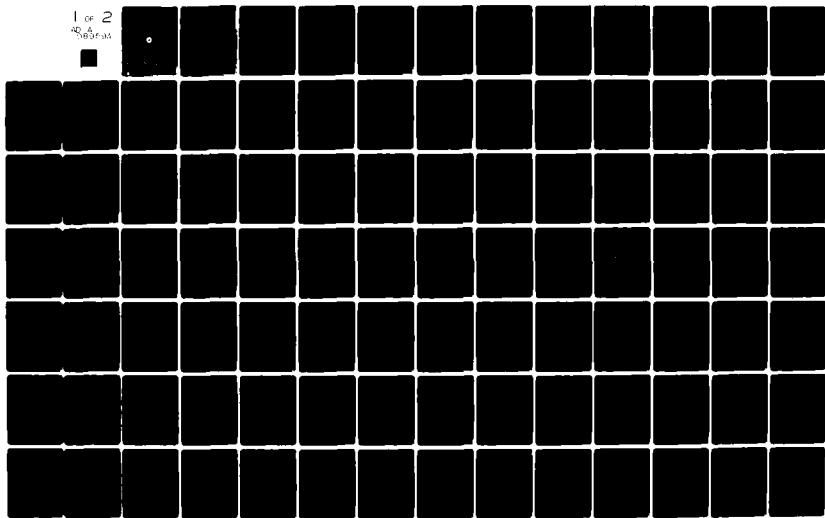
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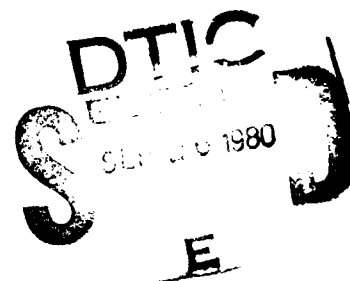
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## ENERGY EFFICIENCY OF SEA AND AIR VEHICLES

DAVID A. JEWELL  
U. S. COAST GUARD ACADEMY



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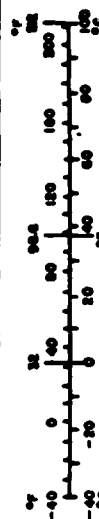
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# METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures				Approximate Conversions from Metric Measures			
Symbol	When You Know	Multiply by	To Find	Symbol	When You Know	Multiply by	To Find
<b>LENGTH</b>							
m	inches	2.5	centimeters	m	millimeters	0.04	inches
ft	feet	30	centimeters	cm	centimeters	0.4	inches
y	yards	0.9	meters	m	meters	2.2	yards
mi	miles	1.6	kilometers	km	kilometers	1.1	miles
<b>AREA</b>							
sq in	square inches	6.5	square centimeters	sq cm	square centimeters	0.16	square inches
sq ft	square feet	0.09	square meters	sq m	square meters	1.2	square yards
sq yd	square yards	0.8	square meters	sq mi	square miles	0.4	square kilometers
ac	square acres	2.5	hectares	ha	hectares (10,000 m <sup>2</sup> )	2.5	square miles
mi <sup>2</sup>	square miles	0.4	hectares	<b>MASS (weight)</b>			
<b>MASS (weight)</b>							
g	grams	20	grams	g	grams	0.005	ounces
kg	kilograms	0.45	kilograms	kg	kilograms	2.2	pounds
lb	pounds	0.5	kilograms	ton	tonnes (1000 kg)	1.1	short tons
<b>VOLUME</b>							
l	liters	1	liters	l	liters	0.03	fluid ounces
qt	quarts	1.1	liters	qt	quarts	2.1	pints
pt	pints	0.47	liters	pt	pints	1.06	quarts
gal	gallons	3.8	liters	gal	gallons	0.38	quarts
cu ft	cubic feet	0.03	cubic meters	cu m	cubic meters	35	cubic feet
cu yd	cubic yards	0.76	cubic meters	cu yd	cubic yards	1.3	cubic meters
<b>TEMPERATURE (exact)</b>							
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature

\* 1 in = 2.54 exactly. For other exact conversions and more detailed tables, see NIST Inc. Publ. 285, Guide to SI Units and Conversions, Price \$1.25. © Copyright Inc. C-110286.



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# NOMENCLATURE

A	Aspect ratio of a wing, foil or lifting surface; $s^2/S$ .
B	Breadth of vehicle
c	Chord length; distance from the leading edge to trailing edge of a foil
C	Coefficient, normally used with subscripts
$C_D$	Drag coefficient; $D/(1/2) \rho_f V^2 S$
$C_{D0}$	Profile drag coefficient
$C_{Di}$	Induced drag coefficient; $C_L^2 / \pi a e$
$C_L$	Lift coefficient; $W/(1/2) \rho_f V^2 S$
$C_v$	Total volumetric coefficient; $\dot{V}/LBT$
D	Drag
e	Aerodynamic efficiency; specific resistance
E	Transport efficiency; $WV/P$
F	Froude number; $V/\sqrt{gL}$
g	Acceleration of gravity
G	Specific energy
L	Length, overall, of vehicle
P	Power installed and available continuously; shaft horsepower
s	Span length of a lifting surface; distance from wing tip to wing tip. For a single-sided appendage like a rudder, the span is the distance from wing root to wing tip
S	Lifting surface area (planform)
t	Time
T	Thrust (static) available; depth of vehicle
V	Speed, maximum, of vehicle
W	Weight, maximum

$\eta$  Overall propulsive efficiency;  $EHP/(P+TV)$   
 $\rho$  Density;  $\rho_f$  - fluid,  $\rho_v$  - vehicle  
 $V$  Total enclosed volume of a vehicle; (NOT displacement)

# 1

## ABSTRACT

A reassessment of naval vehicle performance leads to the definition of specific energy as a significant measure of vehicle performance. Specific energy is an energy efficiency equal to the product of transport efficiency and Froude number. In terms of specific energy, the empirical performance data for fluidborne vehicles collapse revealing systematic trends with Froude number for fully-immersed buoyant vehicles, surface ships, and dynamic-lift vehicles. Specific energy appears to be a new consistent basis for comparing the overall technical performance of past, present and future naval vehicles.

## BACKGROUND DISCUSSION

### INTRODUCTION

It would be very helpful if we had a measure for evaluating the relative worth of vehicles. The measure of worth would be all the more valuable if it was related to the efficient use of energy, to the first principles of physical mechanics, to the various technologies for the primary vehicle subsystems and to the costs of the vehicle. Such a measure would be easy to use if it could be expressed in terms of a simple number which applies to all powered vehicles. Such a lofty goal sounds somewhat like a pipedream. Perhaps we are closer to realizing some of these aims than we have been aware.

Simple comparative evaluations of the engineering merits of water- and air-craft could be quite helpful in selecting those vehicles which are needed to carry out Coast Guard missions. It could help us get more productive capability for the energy expended and put our money to best use. It could help us decide what subsystem technology developments to pursue with scarce development dollars and thus gain the most improvements in performance of future ships, boats, and aircraft.

This work is but a first step in the attainment of a few of those elusive goals. The approach used is rather fundamental and is based on empirical data. An original paper from 1950 forms the basis for the proposed work. In this section that original paper and the subsequent development of its ideas are described. The expansion of lift-drag-ratio is traced, via specific power, to transport efficiency as a promising measure of overall vehicle performance. Attention is paid here to both the promise and its limitations of the original work. The inconsistencies

are given to show what must be overcome to gain our objectives.

In the second section, the approach to the problem is presented. Specific energy is evolved and described. This provides a new basis for analyzing the technical data.

In the third section, the data are presented. The way in which the data were collected, grouped and treated is given in brief.

In the fourth section, the plotted data are discussed. The trends are described and the implications are addressed.

The main text ends with the conclusions. It is not intended to answer all the questions posed or to resolve the conundrums in one fell swoop. It is intended to gain a new basis for answering many of those questions and to resolve many of the inconsistencies by gathering current vehicle data, by replotting them and reanalyzing them. The complete details of the data are given in the appendix.

#### BACKGROUND

The growth in kinds of vehicles since the turn of the century makes it sometimes difficult to select the best craft to buy from the wide variety of available craft. For future operations, with expanding Coast Guard missions, it can be particularly difficult to choose, for instance, between a cutter-based helicopter, an air cushion vehicle, or a hydrofoil. Perhaps the future cutter should be a small-waterplane-area-twin-hull (SWATH) ship. Will an airship be needed to supplement the other air-surface craft of the future? On an intuitive basis, one might feel sure that one or more of these, or a follow-on surface-effect vehicle of some sort, will have a valuable role in the Coast Guard. But how does one tell? Without getting

into questions of mission effectiveness, let us review those aspects of the history of engineering measures which led to the present work.

#### LIFT DRAG RATIO

In this century, the dimensionless lift-drag ratio has been used as a simple measure of vehicle performance. This simple force ratio has served developers well for a long time. It was sometimes called the "drift" or "gliding" ratio and indeed still relates directly to vehicular performance.

#### WHAT PRICE SPEED?

It appears that a good basic approach to the vehicle evaluation problem was put forth by Gabrielli and von Karman at the end of World War II. They collected and analyzed data on all kinds of vehicles and presented their work in a paper entitled "What Price Speed?"\* They stated, "the problem of comparative merits of various means of locomotion is considered merely from an engineering point of view." Their work covered submarines, railway vehicles, trucks, cars, airships, helicopters and several classes of ships and airplanes. They plotted values of the installed power (P) divided by vehicle gross weight (W) as a function of maximum speed (V) for each type of vehicle. Gabrielli and von Karman also used a dimensionless quantity,  $e = P/WV$ , which was called "specific resistance". From these data they found an envelope which represented the minimum value of specific resistance for each group of vehicles. These envelopes are called "group curves". The group curves were then transferred to one

\* A complete listing of references is given on page 37 in a alphabetical order by author's name. If any author has more than one reference, the year of the report is given in the text.

diagram as shown in Figure 1. That figure does not show all of the Gabrielli von Karman data. That figure was taken from a report by Mandel (1969) who removed all of the land vehicles. The present author added the curve for hydrofoils as of 1973.

#### LIMIT LINE

An overall limit line was found for the minimum value of specific resistance, considering all vehicles. Along this line, which will be called the GvK line or the limit line herein, the specific resistance is proportional to the maximum speed. The equation for this line was expressed:  $e = 0.000175 V$  (where  $V$  is in miles per hour).

Their diagram reveals a surprisingly consistent trend. It is remarkable that such dissimilar vehicles as merchant ships, railway cars and high-speed airplanes, when considered together, should be the vehicles which require the least installed power per unit vehicle momentum  $(P/WV)^*$ . The position of the limit line changes slowly with time. As new vehicles are developed, the limit line moves so that its position can be identified at, say, the end of each decade, i.e., 1950, 1960, 1970, etc.

On an empirical basis, this limit line represents the "best" vehicles which humans had put together with the technology available at the time.

#### TRANSPORT EFFICIENCY

Most people now use the inverse of specific resistance ( $E = 1/e = WV/P$ ) which is called "transport efficiency". An equivalent expression

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\*It has become usual practice, in this connection, to speak of weight momentum  $(WV)$  rather than mass momentum.

for this parameter is the product of overall propulsive efficiency ( $\eta$ ) and lift-drag ratio ( $W/D$ )\*. Propulsive efficiency can be defined as the ratio of effective horsepower to shaft horsepower ( $\eta = \text{EHP}/\text{SHP}$ ). Because EHP is just drag times speed ( $DV$ ) and installed power ( $P$ ) is the shaft power, it follows that  $WV/P = \eta W/D$ . This shows how simply transport efficiency is related to lift-drag ratio. Both parameters are non-dimensional.

Something about "What Price Speed?" can capture the imagination. Soon after that paper appeared, several investigators tried to develop the original ideas of Gabrielli and von Karman. Davidson (1951A, 1951B, 1954, 1957), Lewis, Crewe, Mandel (1962), Gouse and Swarden, and Silverleaf and Cook, tried to evaluate or compare various craft, at least in part, on the basis of such data. The scope of those studies is extremely broad. It encompasses virtually every kind of vehicle known and involves a very wide variety of vehicle performance factors and characteristics. Transport efficiency has the advantage of wide applicability.

Considerable effort was put into finding useful specific equations relating transport efficiency and other technical parameters, although connections with economic factors were sometimes sought. Davidson (1951) made perhaps the most detailed study. One difficulty was that there were too many variables. In a sense, part of the problem was, and still is, to identify the most pertinent parameters. The fact that different nomenclatures are traditional in the fields of Naval Architecture and

---

\*W is used as the symbol for lift because, in equilibrium, the vehicle weight and lift must be equal. The notation L is reserved for use as overall vehicle length.



Aeronautical Engineering complicates the problem.

Other unusual observations were made of the Gabrielli-von Karman work. The original diagram shows apparently continuous coverage of vehicles near the limit line through the entire speed range. When land vehicles are removed from the diagram, as shown in Figure 1, a large vacant space appears between the limit line and the "best" available air-sea vehicles at medium speeds, roughly from 40 mph to 200 mph. Within this triangular-shaped area, there is a single fluidborne vehicle: the airship. Its transport efficiency is quite a bit higher in its speed range than that of any other group of airborne or waterborne vehicles. For this reason, airships have been considered an unexplained exception, although airship advocates may simply say this indicates an airship advantage.

Marine Engineers became more aware of the triangular gap. The proponents of many kinds of marine vehicles seized upon "filling the gap" as a rationale for acquiring development funds. It appears that, at one time or another, the following vehicles were so promoted: planing boats, hydrofoils, hovercraft and wing-in-ground-effect vehicles, either as general classes or in more specific configurations. None of these has demonstrated values of transport efficiency of the airship group and certainly none has even come close to achieving a value close to that of railway vehicles. It is surely pertinent to ask "Why not?" In most cases, the promoters simply over-estimate the potential value of transport efficiency. We shall see that serious over-estimates can be avoided in the future. First it is instructive to discuss the various interpretations of transport efficiency data.

## INTERPRETATIONS

There are several ways of interpreting plots of transport efficiency as a function of vehicle speed. These interpretations generally conform to the notion that least power per unit vehicle momentum is "best":

1. The maximum value of transport efficiency is "best".
2. The vehicle group which has the greatest value of transport efficiency, at given speed, is "best" at the speed.
3. Vehicles which lie closest to the limit line are the "best" vehicles, for a given state of technology.

The first interpretation leads to consideration of large tankers (super-tankers) as the "best" vehicle and to the further conclusion that they are "best" when their speed is least. Thus the "best" vehicle would be a ship at zero maximum speed where its transport efficiency is limitless. This interpretation would apply to any displacement vehicle as well. The second interpretation is better, but leaves us seeking an explanation for the continued use of vehicles whose transport efficiencies are significantly less than airships. The reasons must lie elsewhere.

This leads to the third interpretation. The difficulty with this last interpretation is that we need a convenient way of applying this criteria. What is needed is a direct quantitative way of expressing the distance that any vehicle group curve lies from the limit line. Peter Crewe published a way of overcoming this difficulty in 1958. He undertook an evaluation of the future prospects of hydrofoil craft. This work included a most well-considered (and extended) use of transport efficiency as a measure of vehicle performance. He pointed out that when the data were plotted in terms of  $WV^2/P$  as a function of  $V$ , the limit line appears

as a constant maximum value\*. He expressed the value as 750 ton-knots/horsepower, which is equivalent to 5160 knots. Crewe's figure, reproduced here as Figure 2, shows that the hydrofoil group curve crosses the destroyer group curve at 35 knots and both groups have significantly lower transport efficiencies than large tankers or airplanes. The airship group curve is not shown in Figure 2, but would lie near the middle of the triangular area. A way of using Crewe's parameter will be described in the next section.

Transport efficiency can be used in many other connections. It can be extended to indicate the comparative performance of marine vehicles in rough water as well as in calm water (Silverleaf and Cook). It is directly proportional to range (Jewell). Specific power\*\* is the primary determinant of vehicle first costs and vehicular cost growth with time (Dix and Riddell).

Thus it seems certain that some form of transport efficiency is a significant measure of vehicle worth. In a sense, the GvK line covers much more than technical factors. In a broad sense, it is influenced by all of the factors considered by those who built and paid for every vehicle ever made. In this sense, the limit line is representative of the economic, political, legalistic and militaristic considerations as well as the technical limits of vehicle performance. It is an empirical definition of vehicle limits. But what of the limitations of the previous interpretations and applications. How can these limitations be removed?

\*The equation  $e = 0.000175 V$  leads to this constant as  $P/WV^3 = 0.000175/\text{mph}$  or  $WV^2/P = 5710 \text{ mph}$ .

\*\*Specific power is the power-to-weight (P/W) ratio.

## APPROACH

A critical examination of the works cited show that Gabrielli and von Karman were on the right track; that the limit line represents the "best" vehicles in an empirical and significant way.

What is lacking is a simple numerical way of making that information useful: that is, "What quantitative measure can be used to find the distance that the any vehicle "Group Curve" lies from the GvK line. Crewe's work leads to a simple answer to this question, however, Crewe's parameters  $WV^2/P$  (and  $V$ ) are both dimensional rather than nondimensional (as is  $WV/P$ ). Also, the size and exceptional position of airships with respect to all other air-sea vehicles indicates that the size of vehicles needs to be taken further into account.

Taken together, these two facts led the author to use a non-dimensional form of vehicle velocity. Many of the works already cited express speed in a dimensionless way. There appears to be no simple "right" way, but there were several choices. Two of the choices were the Froude number ( $F$ ) used mostly in Naval Engineering and the inverse square root of lift coefficient ( $C_L$ ) of Aeronautical Engineering. Froude number and lift coefficient are defined as:

$$F = V/\sqrt{gL}$$

$$C_L = W/(1/2)\rho_f V^2 S$$

where

$L$  = length of vehicle

$S$  = lifting area

$\rho_f$  = fluid density

$g$  = acceleration of gravity

By definition  $C_L^{-\frac{1}{2}} = V \sqrt{\rho_f S / 2W}$ . The two parameters  $F$  and  $C_L^{-\frac{1}{2}}$  can be directly related. To show this, let the vehicle weight be expressed as the product of the total volume and average density;  $W = \rho_v g \nabla$ , and let a volumetric coefficient be defined as  $C_v = \nabla / LBT$  where  $B$  and  $T$  are vehicle breadth and depth.  $L$  can be any characteristic vehicle length and  $S$  can be any representative vehicle area. With these concepts the lift coefficient can be rewritten:

$$C = \rho_v g \nabla / (1/2) \rho_f V^2 S = 2C_v (\rho_v / \rho_f) (BT/S) F^{-2}.$$

So the lift coefficient is proportional to the inverse square of the vehicle Froude number, and the two characteristics parameters  $F$  and  $C_L$  will apply to any vehicle whatsoever.

Davidson's (1951) work indicated that Froude number based on cube root of vehicle volume is an appropriate way to combine speed and vehicle size in a single dimensionless parameter. It appears that this was a most appropriate parameter to use in place of vehicle speed as the independent parameter (along the abscissa) in any updated version of the Gabrielli von Karman data plots. The trouble with this notion is that the total volumes of vehicles are very hard to find for many vehicles. It is quite easy to use a Froude number based on overall vehicle length.

Now, it is a simple matter to convert Crewe's parameter  $WV^2/P$  to a dimensionless parameter. Simply replace one power of  $V$  in  $WV^2/P$  by  $F$  to get  $WVF/P$  (equals a constant along the limit line). This quantity, denoted by  $G$ , ( $G=WVF/P$ ) can be calculated for any vehicle and any group of vehicles and plotted as a function of Froude number. In this way, any vehicle or group of vehicles can be compared with any other vehicle or group of vehicles in a direct way. The value of  $P$  includes all

installed power, especially for powered-lift vehicles such as air cushion vehicles and helicopters.

For jetpowered craft, static thrust (T) is given rather than installed power. In keeping with Gouse and others, the weight-thrust (W/T) ratio is used instead of WV/P. This notion is extended here to those vehicles which have both reciprocating and jet engines. We use  $G=WVF/(P+TV)$  as the dependent variable. This is a completely general form.

The next observation somewhat reinforces the notion that this approach leads to very significant and useful information.

The quantity G represents a specific form of energy efficiency. This parameter can be rewritten in the form:

$$G = (1/2)(W/g) v^2 / (1/2)(P+TV) \sqrt{L/g}$$

The numerator is just the maximum vehicle kinetic energy  $(1/2)(W/g) v^2$  and the denominator is the driving energy (that is, the total power times time) expended during a time representative of the vehicle size,  $t = (1/2)\sqrt{L/g}$  (a specific time)\*. We can regard the kinetic energy as output and driving energy as input. So the quantity G is called "specific energy" representing overall energy efficiency.

---

\* The time  $t = (1/2)\sqrt{L/g}$  is just one half of the time it would take a vehicle of length (L/2) to move its own length if it were accelerated from rest at the acceleration of gravity.

## DATA

Data on over 500 classes of vehicles are listed in the Appendix. The "data" are the values of the vehicle overall length (L); maximum, fully-loaded or gross weight (W); maximum speed (V); maximum continuous rated power (P), installed and available; and static thrust (T). Clearly there are wide variations in the ways the values of these quantities are determined for the wide variety of vehicles covered here. Even for a given vehicle, one finds wide variations in the values in the literature. In many cases, the author had to choose among different values and often the data listed for a single vehicle represent a composite of data obtained from several sources. In general, the largest value published by a reputable source was used as the value of each parameter. It would be impossible, however, for most vehicles to make the stated maximum speed at the maximum weight with the maximum power available, even on a good day, let alone in poor weather. The justification for using data in such a way is just the same as that of Gabrielli and von Karman. When all of the data are put together, they show remarkable consistency and trends, which means that the inaccuracies in the data are generally smaller than would interfere with the overall trends and comparisons.

Most of the data were obtained from readily available library sources such as JANE'S ALL THE WORLD AIRCRAFT, and various summary papers such as those by Mantle and Hoerner. In a few cases, confidential data were used to compute the values of E, F and G. In order not to reveal any classified information, only the values of E, F and G are retained herein, (along with the references for those cases). The original data and vehicle identification were changed and fictitious information was put into the

the computer to keep the results together. In those cases, a note was put in the remark.

In keeping with current practice, the values are given in both engineering units and metric units. Furthermore, weight is given in both long tons and in pounds for all vehicles. Velocity is given in both knots and feet per second.

The name of each vehicle class is given along with remarks in the appendix. Remarks generally include:

1. alternative designations of the vehicle class;
2. the name of the builder, designer, operator, or owner;
3. the references from which data was obtained, in abbreviated form;
4. other remarks, such as classification (or other limitations on data).

A vehicle class is a vehicle and all other vehicles which are essentially like it. The word class is used in the sense of naval usage where DD963 class destroyer means any of several destroyers of the same design with various hull numbers. There may be hundreds of aircraft, which were mass-produced, in a class. On the other hand, a class may be a unique vehicle, such as the hydrofoil HIGH POINT (PCH-1).

In collecting the data, a distinction has been made between vehicles which have been built and vehicles which have been designed. A star (\*) at the end of a vehicle class name (and in the plotted data) indicates that the vehicle exists only as a design or in conceptual form.

For ease of handling the voluminous data, the vehicles were grouped



in somewhat narrower subdivisions than were used by Gabrielli and von Karman. The kinds (types) of vehicles have increased since then. For instance, hydrofoils were separated into fully submerged, surface-effect and surface-piercing groups. That is, separate files were set up in the computer for each group. When the plotted data are examined, one can see systematic trends for each group. Nevertheless, the differences are relatively small, so a single envelope was drawn for all hydrofoil data, i.e., all hydrofoils are treated as a single group. This method helps keep the clutter down on the summary figure.

As a result, there are 35 groups as listed in Table 1.

TABLE 1

Submersible	Planing
Submarine	Air cushion vehicle
Airship	Surface effect ship
Torpedo	Wing-in-surface-effect
Large transport ship	Helicopter
Small transport ship	Historical airplane
Navy Auxiliary	Seaplane
Navy Amphibious	Surveillance (observation)
Coast Guard Cutter	Light airplane
Coast Guard Boat	Patrol
Aircraft carrier	Cargo airplane
Battleship	Passenger airplane
Cruiser	Bomber
Destroyer/frigate	Fighter/Attack
SWATH	Research
Hibrid concept	Space
Fully-submerged hydrofoil	
Surface-effect hydrofoil	
Surface-piercing hydrofoil	

Some thirteen figures were prepared in which the computed values of specific energy were plotted. Each figure contains from one to six groups of vehicles. For each group, an envelope was drawn generally approximating the locus of the maximum values of specific energy for the vehicles in the group. Two groups (Battleship and SWATH) contain one vehicle, so that

value is indicated by a letter on the figure. All of the computerized data are in the appendix. After all of the group envelope curves were drawn, they were transferred to summary figures from which a few lower-included group curves were omitted for clarity. The figures are presented in the next section.

## RESULTS

In this section, interpretations of the plotted data are given. The specific energy data for the 35 groups are plotted in Figures 3 through Figure 14. The data are summarized on Figures 15 and 16.

### SUBMERSIBLE AND SUBMARINE (Figure 3)

Submersibles generally have the lowest Froude numbers. This is the only group with Froude numbers less than 0.1, although most submersibles fall between 0.1 and 0.4. They vary greatly in values of specific energy from a high of 57 (for ALUMINAUT) to a low of 0.75 (DENISE).

Navy Submarines generally have greater Froude numbers (around 0.4) and greater specific energy than Submersibles. ALBACORE, now retired, had the greatest Froude number due to its combination of high speed and small size. The Submarine with the least value (9.5) of specific energy is the Soviet F, although the Soviet H and N classes have relatively large values of both Froude number (0.48 and 0.47) and specific energy (27 and 26). It is possible that the Soviet subs have classified speeds in excess of those found in the open literature, however. This would imply very good performance compared with U.S. submarines.

#### AIRSHIP AND TORPEDO (Figure 4)

The Airship is a fairly old vehicle group, however, six new airship concepts have been included. The Goodyear ZPG-X concept appears to be a reasonable improvement in the state of technology. The airship design with the greatest Froude number is being built in England by Aerospace Development, Ltd. It is a relatively short airship (164 feet). The airship class with the greatest value of specific energy (18 at  $F=0.8$ ) is the AKRON-MACON. The lowest is the Navy ZPG-3W ( $G=6.8$  at  $F=1.0$ ).

Torpedoes, because of the needed higher speeds and smaller sizes than submarines, have much greater Froude numbers (2 to 4). They also have relative low values of specific energy (3 to 6).

These two vehicles show how specific energy typically decreases with increasing Froude number.

#### TRANSPORT SHIPS (Figure 5)

The group of Large Transports include two container ships of 59000 long tons and 26700 long tons and one medium tanker of 49660 long tons. The rest are large tankers, over 100,000 long tons. The tanker with the largest value of specific energy (183 at  $F=0.13$ ) is the Esso Atlantic.

The other transport ships range in gross weight from 8000 long tons to 22000 long tons. All except one are dry cargo ships.

The Auxiliary group includes a variety of Navy ships, all of whose designations begin with the letter A. The group includes ammunition ships, store ships, oilers, destroyer tenders, two catamarans (ASR 21 PIGEON and AGOR 16 HAYES), an oceanographic research ship (AGOR 14 MELVILLE) and a survey ship (T-AGS 26 BENT). The last four of these have relatively low values of specific energy. The rest, because of

their necessary high speeds, exhibit the decreasing values of specific energy with increasing Froude number typical of surface ships.

#### AMPHIBIOUS AND COAST GUARD (Figure 6)

The group of Amphibious ships (Navy ships with designations beginning with the Letter L such as LKA, LPA, LSD, LST and LCU) illustrates the sharply declining values of specific energy with Froude number for surface ships. These fall off from  $G=61$  at  $F=0.23$  to a low of  $G=1.2$  at  $F=0.45$  (for LCVF). The second lowest ( $G$  value) in this group is for Dandini's Hydro-sphere, a spherical vehicle which rolls across the water surface.

Generally Coast Guard Cutters have slightly larger Froude numbers for the same values of specific energy. The "cutter" with the largest specific energy is the Barque EAGLE under power. Otherwise the cutter with the largest value of specific energy is the WMEC 230 STORIS ( $G=28$  at  $F=0.27$ ). The new WMEC 270 class falls right on the trend line at moderately high Froude number with a correspondingly moderate value of specific energy ( $G=11.7$  at  $F=0.35$ ). The Hamilton class cutter (WHEC 378) has the largest Froude number of all cutters ( $F=0.44$ ) and a moderate value of specific energy (10.4).

At first glance, Coast Guard Boats have an almost random spread. Closer observation indicates that those with Froude numbers less than 0.5 show the continuing decline in specific energy values with increasing Froude number. Those with Froude numbers greater than 0.5 show that specific energy (of the most efficient boats) begin to increase with increasing Froude number. This behavior of the data indicates that the wavemaking hump speed has been exceeded and wave-making drag begins

wavemaking hump speed has been exceeded and wave-making drag begins to decrease. In fact, these boats have begun to plane. Below hump speeds, the WLI 100C (BUCKTHORN) has the largest specific energy (at  $F=0.35$ ) with the Dogwood 259 (WLR 114 class) and WYTM 110 Harbor Tug nearby. Near hump speed ( $F=0.48$ ), the Motor Cargo Boat does about as well as any surface vessel could ( $G=3.2$ ). Above hump speed, we find just what could be expected; the 82 foot and 95 foot Patrol Craft and the 44 foot Motor Lifeboat.

#### NAVY COMBATANT (Figure 7)

The Navy combatant groups with the lowest Froude numbers (about 0.31) are the large Aircraft Carrier and Battleship which have moderately high values (19 to 24) of specific energy. Cruisers, the next largest ship, have higher Froude numbers (from 0.37 to 0.44) and the next lowest specific energy. The best of these is the CGN-9 LONG BEACH with a value of 20 (at  $F=0.39$ ). At the lower end of the Cruiser group are three DLG class (DLGN 35, DLG 26 and DLG 16) which were grouped with Cruisers because of their large displacement (over 7500 long tons).

The Destroyers with the largest values of specific energy overlap the Cruiser group. These Destroyers have relatively low Froude numbers; 0.37 for DD 1033 CLAUDE JONES and 0.40 for DD 1037 BRONSTEIN. At the other end of the Destroyer group, we find DD 710 GEARING ( $F=0.51$ ) and DD 692 SUMNER ( $F=0.52$ ). Their specific energy values (7.0 and 6.7) are substantially greater than those of the best boats at the same Froude number.

On this same Figure is shown the datum for the SSP KAIMALINO, the only SWATH ship for which we have data. Just above this is found a loop

are hybrid combinations of demi-SWATH, hydrofoil and air cushion vehicles with nominal 2000 long tons gross weights and with nominal maximum speeds of 45 knots. They have 60000 shaft horsepower.

#### HYDROFOIL (Figure 8)

This group of vehicles has values of specific energy from about 5 to 15. The three kinds of foil systems span a wide range of Froude numbers. The surface-piercing type cover the range, while the surface effect (Soviet) type have low values of Froude number and the fully-submerged foil systems fall in the middle range of Froude numbers with a relatively sharp peak in specific energy at  $F=1.8$  (Navy/Coast Guard FLAGSTAFF, TUCUMCARI and WILSON ALBATROSS).

#### AIR CUSHION AND PLANING (Figure 9)

Air Cushion Vehicles (ACV) and Surface Effect Ships (SES) have about the same values of specific energy and Froude number as hydrofoils. The best ACV's are the Soviet SORMOVICH ( $G=14.1$  at  $F=2.3$ ) and the new SEDAM N500 ( $G=15$  at  $F=1.7$ ). The three SES data fall very close to the planing craft curve.

Ordinary planing craft have about the same Froude numbers as hydrofoils and air cushion vehicles. The HMS BRAVE BORDERER is probably the fastest surface ship in commission in any navy today at 55 knots maximum speed. Larger values of Froude number are achieved by racing hydroplanes. The datum for the Boeing HTS is representative of such craft. The values of specific energy for these vehicles are moderate. Four Coast Guard boats were included because they have Froude numbers greater than one.

The one on the planing group curve has a specific energy value of 7.4 (UTM MK III Medium Utility Boat). The others are the UTB MK IV Large Utility Boat, the UTL 16 foot Motor Launch and the TICWAN Aids-to-Navigation Boat. These last three have about the same values of specific energy as the boats listed in the boat group with Froude numbers just above the wave making hump.

#### HELICOPTER AND WING-IN-SURFACE-EFFECT (Figure 10)

Now we turn to airborne vehicles. These have slightly large Froude numbers (2 to 6). They illustrate a trend of continually increasing values of specific energy with increasing Froude number. This trend is typical of dynamic lift vehicles.

The envelope curve for the Helicopter group has a very steep slope. The author suspects that the helo with the highest specific energy is atypical. It is the Rotor Craft RH-1 Pinwheel, a one-man device which is strapped onto a man's back. The whole thing weighs about 400 pounds, including the man. It is powered by two jets at the blade tips. Each jet has a static thrust of 20 pounds. The blade diameter, which is also taken as the "vehicle" length, is 16 feet. The rig travels up to 61 knots. The other helos top out with a specific energy value of 23.

The Wing-In-Surface-Effect (WISE) group includes what are usually called WIG (Wing-in-ground-effect vehicles) as well as "ram wing" vehicles and channel hull or tunnel hull vehicles. These are still in a very early stage of development even though over fourteen have been built. Two of these are open sea racing boats; KUDU I and KUDU II ( $G=10.4$  at  $F=4.3$ ). The two WISE vehicles with the highest specific energy value ( $G=25$ ) are

the X-112 and X-113 designed by Lippisch. The two conceptual WISE indicate a reasonable improvement in the state of technology.

#### SEAPLANE AND LIGHT AIRPLANE (Figure 11)

The groups shown in this figure are what might be considered low-performance airplanes. Historical aircraft have very nearly the same Froude numbers and specific energy values as the WISE group. The first successful, manned and powered vehicle in sustained flight, the Wright (brothers) Flyer is shown next to the lower end of the envelope (with  $G=8.4$  at  $F=1.7$ ). Virtually all of the other very early airplanes, mostly European, have lower values of specific energy. The two historic airplanes with greater values of specific energy and Froude number are the NC-4 ( $G=15.9$  at  $F=3$ ) and the Ford/Stout "Tin Goose" trimotor airplane ( $G=19.3$  at  $F=4.9$ ), a couple of which are probably still flying.

The "Megalifter" concept is shown here simply for convenience because it lies almost on the Historical airplane curve. The Megalifter is a hybrid of an airship and a large aircraft.

The group, Light Airplane, includes many personal airplanes, trainers and low-speed surveillance planes. The Mohawk OV-10 has the largest specific energy of these ( $G=101$  at  $F=15.2$ ). The Coast Guard HU 25A (Falcon 20) falls in this group with  $G=52$  at  $F=13.9$ . As a group, the Light Airplane appears inferior to the Seaplane.

The Seaplane group covers about the same Froude number range as Light Airplane, but has somewhat higher values of specific energy at the same Froude number. The seaplane with the highest value of specific energy is the Grumman HU 16E Albatross (amphibian) ( $G=98$  at  $F=9.5$ ).



#### TRANSPORT, PATROL AND BOMBER (Figure 12)

Transport airplanes include both Passenger and Cargo groups. It is not clear why the Cargo group should exceed the Passenger group by such a significant amount. Three Cargo planes, the Superconstellation, the Hercules C 130H (Coast Guard) and the C 130K (G=120 at F=11) are higher in specific energy than any passenger plane for which we have data. The Vickers Viscount 700 has a specific energy value of 78 at a Froude number of 9.2. The Concorde has the largest Froude number (G=69 at F=26).

The Patrol plane group lies midway in Froude numbers in Figure 12. The Orion PC-3 (G=98 at F=11) and the Mercator P4M-1 (G=87 at F=9.8) have very high values of specific energy.

The Bomber group includes a wide variety of planes ranging from the World War II B-17 (G=88 at F=9.5) and B-24 (G=93 at F=9.4) to the B-58 Hustler (G=97 at F=36) and B-70 Valkyrie (G=108 at F=35). The B-1 design datum is at G=86 and F=26. The Three Soviet bombers Beagle, Bison and Badger lie in the middle of the group.

#### FIGHTER AND RESEARCH (Figure 13)

These groups have even greater Froude numbers and specific energy values. There are several fighter planes with specific energy values greater than 100:

P-39 (G=122 at F=19),  
P-47 (G=171 at F=19),  
P51H (G=157 at F=22),  
F84F (G=106 at F=27),  
F111 (G=108 at F=48).

The F7U Cutlass appears to have a comparatively low value of G (17).

The French Mirage and Soviet MIG-23 appear competitive with U.S. fighters

at high Froude numbers.

The Research vehicle group is rather special. The Bell X-1 of many years ago has a very high value of specific energy ( $G=157$  at  $F=77$ ) and the X-15A has an extremely large Froude number ( $F=164$  and  $G=64$ ). The vehicle in this group with the largest value of specific energy is the SR71A plane ( $G=191$  at  $F=52$ ).

#### SPACE (Figure 14)

The last vehicle group is very special, in fact these vehicles are not always "fluidborne". These are the missiles, orbital and space vehicle rocket motors. They are natural continuations of the vehicles covered thus far (Gouse and Swarden). Their Froude numbers vary from 463 to 3710 (JUNO) with values of specific energy of from 126 (VANGUARD) to 2861 (JUNO).

#### SUMMARY (Figure 15)

When the envelopes are superimposed, there appears a very coherent picture of the relative positions of the various vehicles.

At the top of the figure, the overall limit line appears as the line on which specific energy has its constant value ( $G=200$ ). This is defined by the supertankers and research vehicles with the largest value of specific energy. This is the position of the overall limit line as of 1978. The value of specific energy for any vehicle, or group of vehicles, can be compared directly with this value ( $G=200$ ) for overall technical performance.

Perhaps the next most striking feature of the summary plot is the vacant triangle just below the limit line with one vertex with coordinates  $G=15$ ,  $F=1.2$ ; just above where the Airship curve intersects the curves for

Air Cushion Vehicle and Hydrofoil. What this shows is that the Airship is not an exceptional group. In these terms it does not fill an otherwise vacant space. In fact it forms an essential part of one of several important trends.

The foremost trend is formed by drawing a straight line across the upper left ends of the group curves for Submersible, Submarine, Airship and Torpedo. These four vehicles are all buoyantly-supported and fully-immersed in surrounding fluid. They are buoyed up totally by either water or air, and are not close to the air-water interface. The trend formed by these kinds of vehicles is delineated by the line of slope minus one. This line forms the lower left boundary of the vacant space. The line indicates that for buoyant vehicles without wavemaking, the values of specific energy will decrease proportionally with Froude number, i.e.,  $G=K_2 F^{-1}$  along this line. We will return to this equation after considering other trends.

The next trend is that exhibited by wavemaking vessels. The trend is shown by a line of slope minus two which is nearly tangent to the "best" (on a specific energy basis) wavemaking vessels, Transport, Carrier, Cutter, Cruiser and Destroyer. These data imply that the Amphibious and Boat groups are relatively inefficient at Froude numbers from 0.3 to 0.5. On the other hand amphibious ships are relatively efficient at a Froude number of 0.25.

The trend line for wavemaking vehicles has the equation of  $G=K_1 F^{-2}$ . Thus the values of specific energy for vehicles (which are relatively "best") decreases very rapidly as Froude number increases. The envelope for the Boat group shows that the trend ends at a Froude number of about

0.5, the (highest) values of specific energy begin to increase. At Froude numbers above 0.5, boats begin to plane and their lift-drag character begins to change from that of a displacement vehicle to that of a dynamic lift vehicle.

The collection of dynamic lift vehicles appear to define the next trend, which is bounded by a line of slope plus one. The equation of this line is  $G=K_3 F$ . Thus as Froude number increases, the highest values of specific energy achieved increase proportionally with Froude number. This line is anchored at its lower left end by the Air Cushion Vehicles (ACV) and Hydrofoil groups and at its upper right by Cargo Aircraft. Let us consider the various vehicles distributed just below this line proceeding from lower left to upper right.

At Froude number of about 0.75 are found the new SWATH ship and the family of conceptual hybrid marine vehicles. These have values of specific energy about the same as high Froude number Destroyers.

Next we find ACV's and Hydrofoils. These appear superior in specific energy to ordinary Boats above the "hump" wavemaking Froude number. The envelopes for these two groups reach a fairly flat maximum at Froude numbers between 1.5 and 3, where the specific energy values are about the same as those for high Froude number Cruisers. At Froude numbers of about 2, the values of specific energy are substantially less than those on the trend line.

The Planing group is inferior to ACV - Hydrofoils in specific energy value until the Froude number exceeds 3.5. It appears as though the Planing group is not a smooth continuation of high Froude number boats.

Historical Aircraft are shown to peak in specific energy at a Froude

number of about 4.5. The very first aircraft, the Wright Flyer, is found in the midst of Hydrofoils and ACV's, and about the same as low Froude number planing craft.

The next group is the WISE group. Its specific energy values lie substantially below the values on the trend line. The lower left end of this group also falls within the ACV-Hydrofoil-Planing Groups. The upper right end of this group curve falls between Historical Airplanes and Helicopters.

All of the dynamic lift vehicles exhibit the group curves which are characteristic of the lift-drag ratio versus speed curves of dynamic lift vehicles. The Helicopter appears exceptional in this regard.

The group curve for Helicopters rises quite steeply with Froude number changing from  $G=4.5$  to  $G=45$  as Froude number changes from 3.2 to 4.4. It appears that helicopters have not reached a peak in specific energy value. The Helicopter group line approaches the dynamic-lift vehicle trend line at Froude numbers above 4, but rapidly falls away from the trend line below  $F=4$ .

Light Airplanes seem to be a fair continuation of Historic Airplanes. The group curve for Light Airplanes runs parallel to the trend line and has values of specific energy of about one half of those on the trend line.

The group line for Seaplanes lies about midway between the trend line and the group line for Light Airplanes. The Passenger and Patrol Airplane groups have been omitted from this summary figure to avoid clutter.

The Cargo Airplane group has superior values of specific energy in the range of Froude numbers from 5.5 to 12.

The Bomber group curve is relatively high in specific energy compared with most other airplanes, but is relatively low in specific energy compared to Fighters.

The Fighter group curve lies near the intersection of the dynamic lift trend line and the overall limit line. Its values of specific energy are extremely high compared to the values for most other powered vehicles. These also decrease in specific energy values with increasing Froude number, however, falling off markedly above Froude numbers of 30 or so.

At Froude numbers above 40, the Research group line is superior in specific energy values to virtually all powered vehicles. This group curve lies far to the right of the dynamic lift line. So this group, along with Fighters, appears to begin a new trend line (not shown). It appears that, for supersonic flight, a trend line with a fractional slope would apply.

#### SUMMARY WITH SPACE VEHICLES (Figure 16)

In this figure, the group curve for Space vehicles was added to the summary. This helps identify the trend at Froude numbers above 100 or so. What we find is that the values of specific energy for such vehicles surpasses anything else. Its value lie far above the "overall limit line", and far below an extrapolation of the dynamic lift trend line. It appears that a supersonic trend line with a slope of about  $1/2$  is indicated, but this is not certain. Data for vehicles with Froude numbers between 100 to 1000 would be helpful in this regard. In any case, it

appears that the "overall limit line" can be exceeded at extremely great Froude numbers. Thus, the empirical limit line ( $G=200$ ) appears to lose its significance as a limit line at very high Froude numbers.

#### LIMIT LINES

At this point it seems that the line ( $G=200$ ) corresponding to the original limit line should be called a "standard" line. It appears from these results that the trend lines are more precise limit lines for fluidborne vehicles than is the overall limit line. At Froude numbers over 20, a new limit line needs to be established. For Froude numbers between one and 20, the limit line appears to be the trend line of slope plus one. For Froude numbers of about 0.25 to one the limit line is the trend line of slope minus one. For Froude numbers of less than 0.25, the limit line appears to be the trend line of slope minus two. It should be noted that the "standard" limit of  $G=200$  can apparently be exceeded by installing less power in existing supertanker designs. At Froude numbers less than 0.2 or so it should be possible to thereby gain an extremely energy efficient ship. Of course, such a vehicle would take a very long time and distance to accelerate and decelerate.

For each trend line an equation of the form  $G=KF$  can be written. If we use the relation:

$$G = EF = \eta (C_L/C_D) F,$$

the trend line equations can be expressed in terms of lift and drag coefficients or in terms of drag coefficients as a function of Froude number. These relations are listed in Table 2.

TABLE 2

<u>Trend Line</u>	<u>Froude Range</u>	<u>G-F Equation</u>	<u>Drag Coefficient Equations</u>
Wavemaking	Very low	$G = K_1 F^{-2}$	$C_D = k_1 C_L^{-\frac{1}{2}} = c_1 F$
Fully-Immersed	Low	$G = K_2 F^{-1}$	$C_D = k_2$
Standard	All	$G = 200$	$C_D = k_3 C_L^{\frac{1}{2}} = c_3 F^{-1}$
Supersonic (Postulated)	Very high	$G = K_4 F^{\frac{1}{2}}$	$C_D = k_4 C_L^{\frac{3}{4}} = c_4 F^{-\frac{3}{2}}$
Dynamic Lift	High	$G = K_5 F$	$C_D = k_5 C_L = c_5 F^{-2}$

These results conform to engineering experience. The equation  $C_D = k_2$  represents the minimum drag coefficient achieved by man in powered, fully-immersed vehicles; the equation  $C_D = k_5 C_L$  represents the line of maximum, and constant, lift-drag ratio achieved by dynamic lift vehicles.

This author has not seen in the literature the equations of the form  $C_D = c_3 F^{-1}$  for the overall limit line (standard) which indicates that, for traditional vehicles (presumably including land vehicles) the drag coefficient is at least equal to a constant divided by the Froude number. The equation  $C_D = c_1 F$  for wavemaking vehicles indicates that the minimum achievable drag coefficient for surface ships will decrease (proportional to  $F$ ) as  $F$  decreases below values of one quarter. This is as far as such engineering interpretations have been drawn at this writing.



## MAXIMUM SPECIFIC ENERGY OF DYNAMIC LIFT VEHICLES

This section is written to show how differently certain dynamic lift vehicles would be designed and operated depending on whether one chooses to maximize the lift-drag ratio or specific energy. The method of calculation follows that given by Mandel (1969) in "Water, Air and Interface Vehicles". The derivations apply only to dynamic lift vehicles (airplanes and hydrofoils) which have lifting surfaces with constant surface areas. For this purpose, the total vehicle drag coefficient is taken as the sum of the profile drag coefficient,  $C_{D0}$ , and the induced drag coefficient,  $C_{Di}$ , ( $C_D = C_{D0} + C_{Di}$ ). The induced drag coefficient is taken as  $C_L^2 / \pi A e$  where  $A$  is the aspect ratio of the lifting surface and  $e$  is the airplane efficiency factor which accounts for the deviation of the actual foil load distribution from the optimum elliptical loading.

The drag/lift ratio can be written:

$$(D/W) = (C_D / C_L) = (C_{D0} / C_L) + (C_L / \pi A e).$$

The minimum drag-lift ratio can be found by taking the derivative with respect to  $C_L$ , equating to zero, and solving for the value of  $C_L$  (denoted  $C_{LM}$ ). One finds  $C_{LM} = \sqrt{\pi A e C_{D0}}$ . If  $M$  denotes the value of a variable where the lift-drag ratio is maximum, then one finds:

$$v_M^2 = 2W / \rho_f S \sqrt{\pi A e C_{D0}},$$

$$C_{DM} = C_{D0}, \quad C_{LM} = 2C_{D0}, \text{ and}$$

$$(D/W)_M = C_{DM} / C_{LM} = 2 \sqrt{C_{D0} / \pi A e}.$$

Note for further reference, that the induced drag just equals the profile drag at the maximum lift-drag ratio.

One can also solve for the conditions under which specific energy will be maximized by use of the same expressions and by use of the equation.

$$E = \eta W/D. \text{ Thus } G = EF = \eta WF/D = \eta C_L F / C_D.$$

In this case, for ease of computation, one writes  $(\eta/G) = (C_D/C_L) F$ , then writes  $C_L$  in terms of  $F$ , takes the derivative of  $\eta/G$  with respect to  $F$ , equates the derivative to zero and solves for the value of  $F$  (denoted  $F_G$ ) for which  $G/\eta$  is maximized. (If  $\eta$  does not vary with  $F$ , then  $G$  will also be maximum). Here one finds, (using the subscripts  $G$  to indicate the value where  $G$  is maximized),

$$V_G^2 = 3^{1/4} W / \rho S \sqrt{\pi A e C_{D0}},$$

$$C_{DiG} = C_{D0}/3, \quad C_{DG} = 4C_{D0}/3, \text{ and } (D/W)_G = (4\sqrt{3}) \sqrt{(\pi A e / C_{D0})}.$$

Now the values of the various performance factors for maximum specific energy and for maximum lift-drag ratio can be compared. For instance, the ratio of the speed at which specific energy is a maximum ( $V_G$ ) to the speed at which lift-drag ratio is a maximum ( $V_M$ ) is  $V_G/V_M = 3^{1/4} = 1.32$ . Thus the speed at which specific energy is a maximum is 32 percent greater than the speed at which lift-drag ratio is a maximum. Likewise the ratio of induced drag coefficients is  $C_{DiG}/C_{DiM} = 1/3$ . The induced drag coefficient ( $C_{DiG}$ ) is now just one third of the profile drag coefficient. The ratio of total drag coefficients is  $C_{DG}/C_{DM} = 2/3$ , but because the speed  $V_G$  is greater than  $V_M$ , the total drag ( $D_G$ ) is 15 percent greater than  $D_M$  ( $D_G/D_M = 2/\sqrt{3} = 1.15$ ). The effective power ( $DV$ ) is 52 percent greater ( $(DV)_G/(DV)_M = 1.52$ ) when specific energy is a maximum. On the surface, it would appear disadvantageous to maximize specific energy because it requires 52 percent more power to go 32 percent faster and against 15 percent more drag, but the specific energy ( $G/\eta = WF/D$ ) is

14 percent greater  $((WF/D)_G / (WF/D)_M = 3^{3/4} / 2 = 1.14)$ . This means that 14 percent more kinetic energy is gotten per unit of motive energy\*. At this stage, it appears that we are one step closer to realizing a rational answer to the question, "What Price Speed"?

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\*In this calculation, the variation in  $\eta$  with speed is neglected.

## CONCLUSION

Specific energy can be used as a measure of relative overall mechanical performance of fluidborne vehicles.

Empirical data indicates that the energy efficiency of many fluidborne vehicles at sizes and speeds of great interest to humans is very low compared to the best achieved with traditional ships and planes. It appears rather doubtful that values of specific energy much above the trend lines will be achieved unless new forms of vehicle sustentation are employed. The differences between the highest and lowest groups at critical Froude numbers are very significant. At  $F=3/4$ , the best boats have specific energy values ( $G=4$ ) of only four percent of the best research vehicle at  $F=50$ .

The results provide rational support for a number of commonly held beliefs. For instance, the data indicate why airplanes should be used as often as they are today compared with ships and boats (even though airplane transport efficiency values are relatively low). The data also indicate why airplanes should have become so much more popular than hydrofoils even though they both were first successfully demonstrated within a 6 year period. The data indicate that air and sea vehicles are necessarily inefficient on an energy basis at medium Froude numbers.

The results indicate the ACV's and hydrofoils have about the same energy efficiency, both slightly better than planing craft, somewhat better than most destroyers and about the same as airships.

The results show that, on an energy efficiency basis, it would be better to use vehicles above or below the sea surface at Froude numbers from about 0.3 to 1.0.

The results indicate that it is likely that vehicles could be improved in the Froude number range from 2 to 5. This is indicated by the vacant space between the trend line and nearest group curves.

The results imply that energy could be conserved by using vehicles more at very low and very high Froude numbers. The approximate computation indicates that energy may be conserved by operating certain dynamic lift vehicles at speeds greater than would yield maximum lift-drag ratio.

Lastly the results show distinctly different trends for fluidborne vehicles than for all terrestrial vehicles and that several of the limiting trends are of direct engineering significance.

#### ACKNOWLEDGEMENTS

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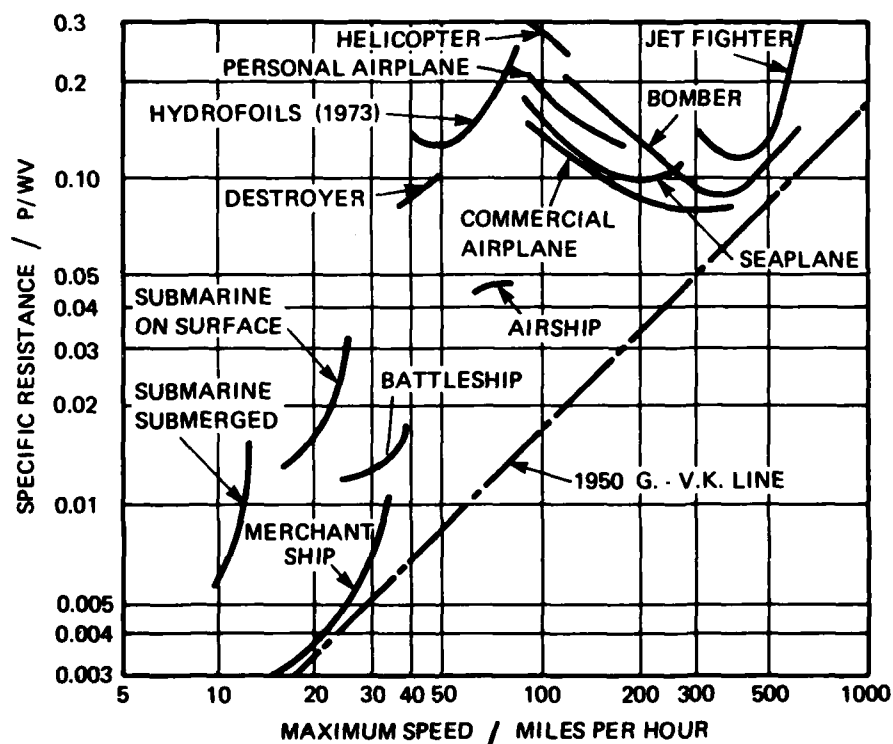


Figure 1 - Specific Resistance of Single Vehicles  
(From Mandel, 1969)

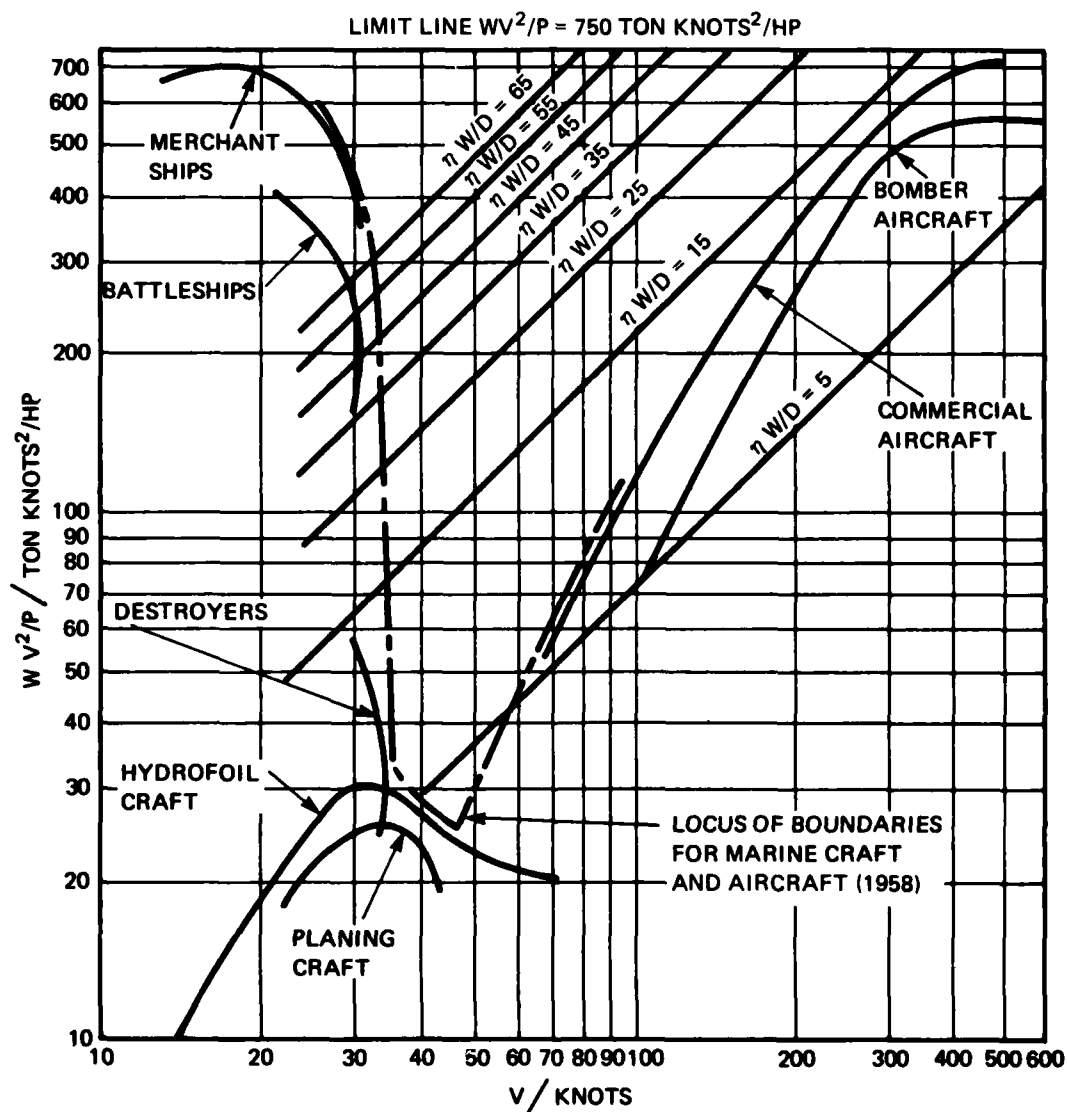


Figure 2 - Lift-Drag Requirements in Critical Triangle  
(From Crewe, 1958)

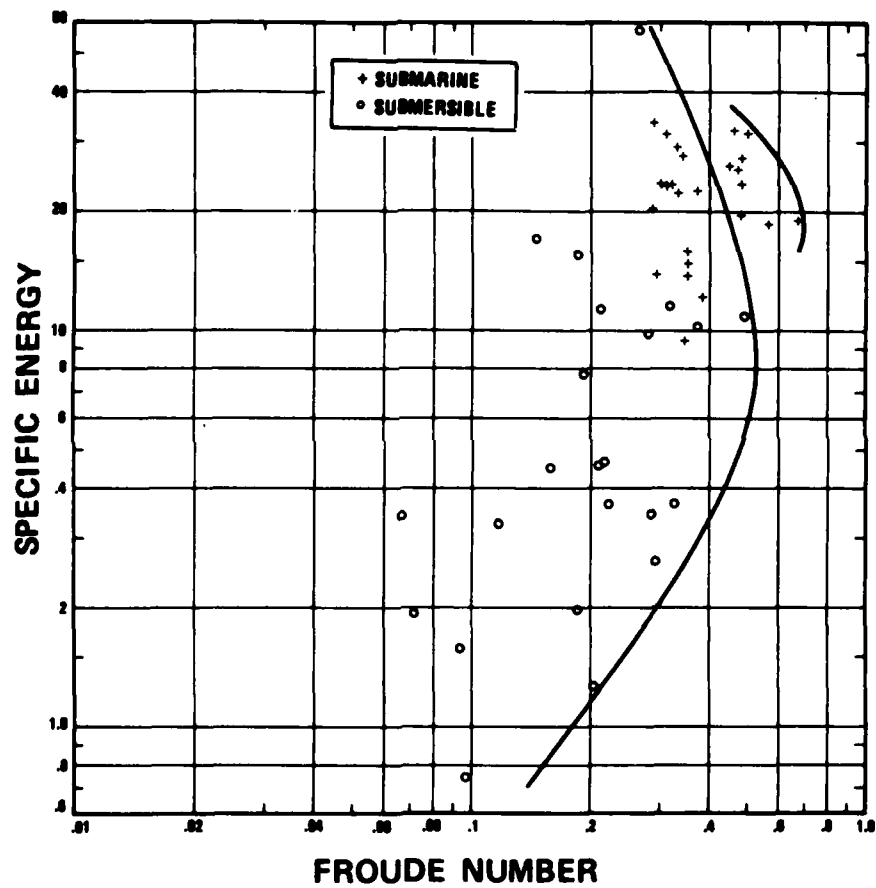


Figure 3 - Submersible and Submarine

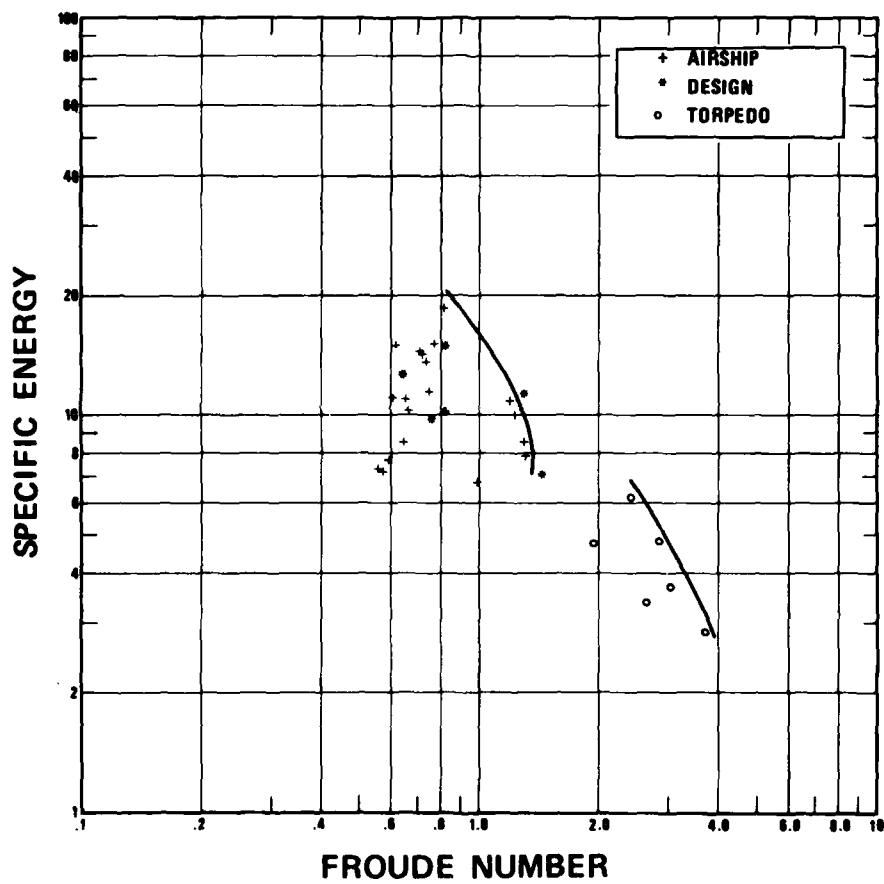


Figure 4 - Airship and Torpedo

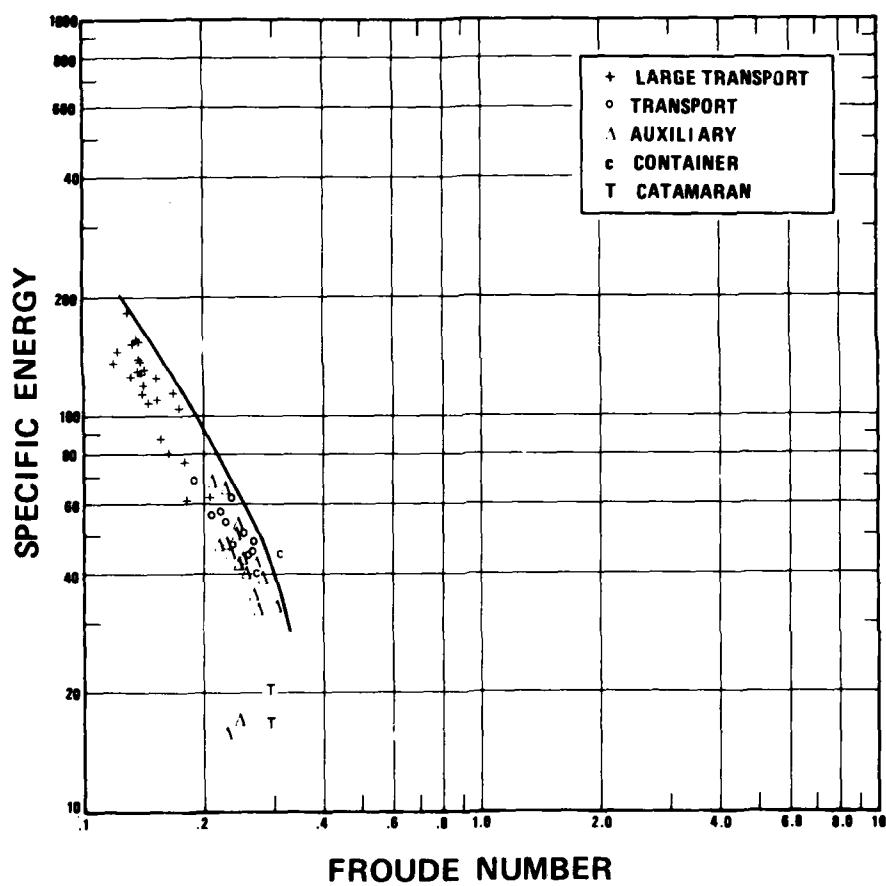


Figure 5 - Transport Ships

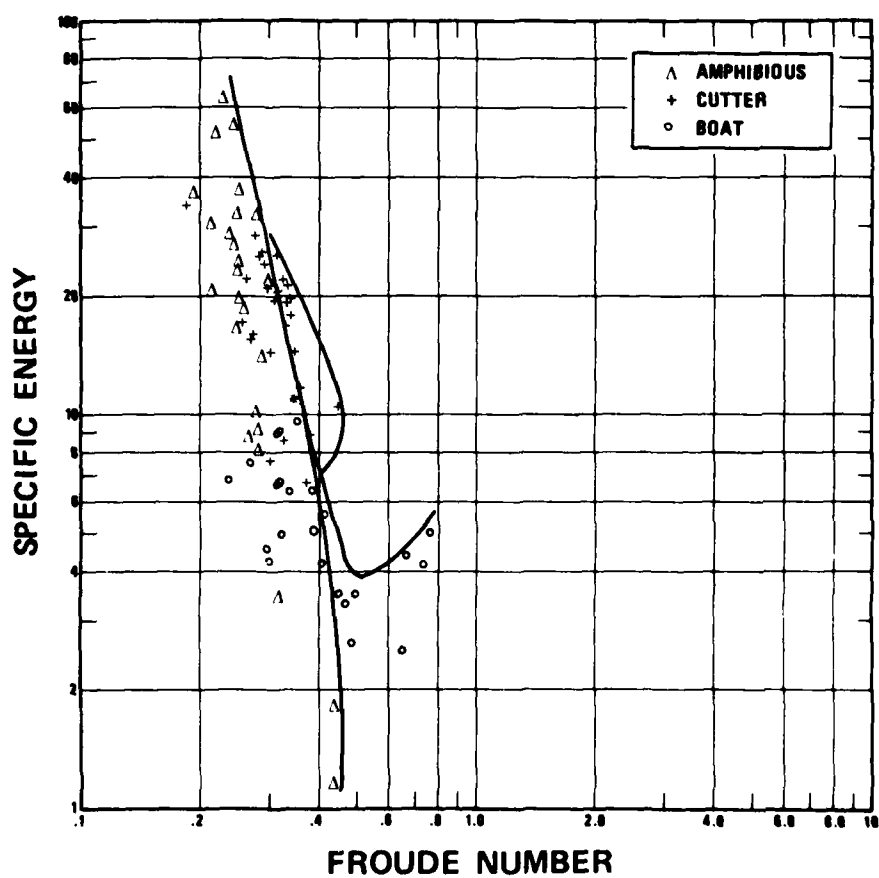


Figure 6 - Amphibious and Coast Guard



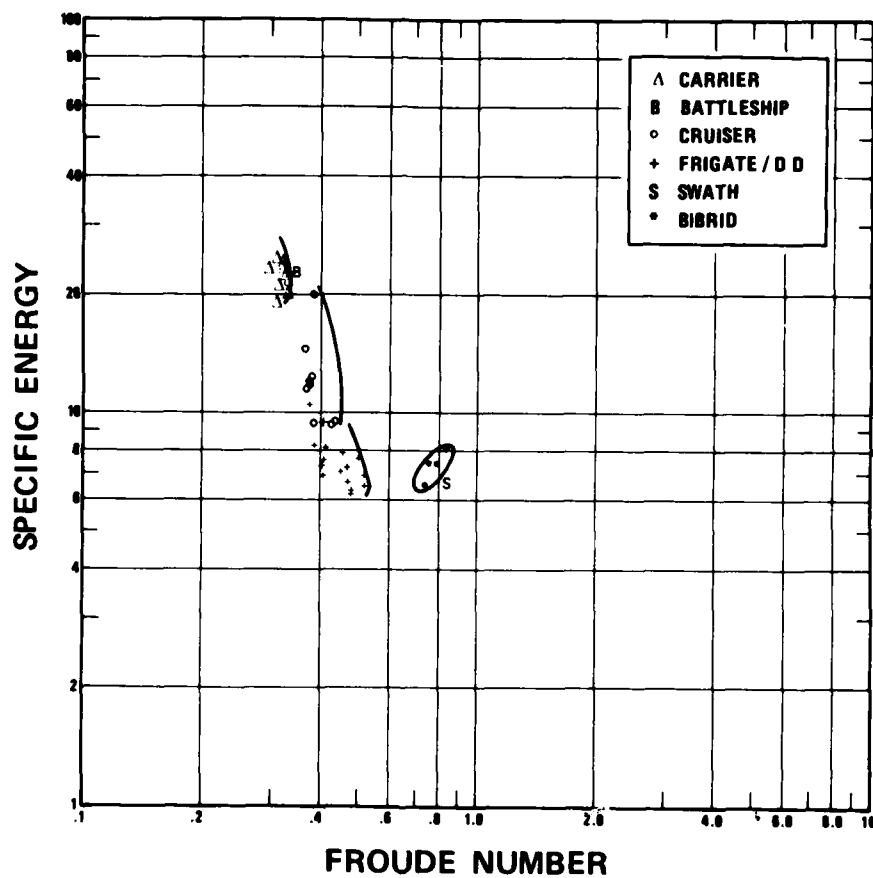


Figure 7 - Navy Combatant

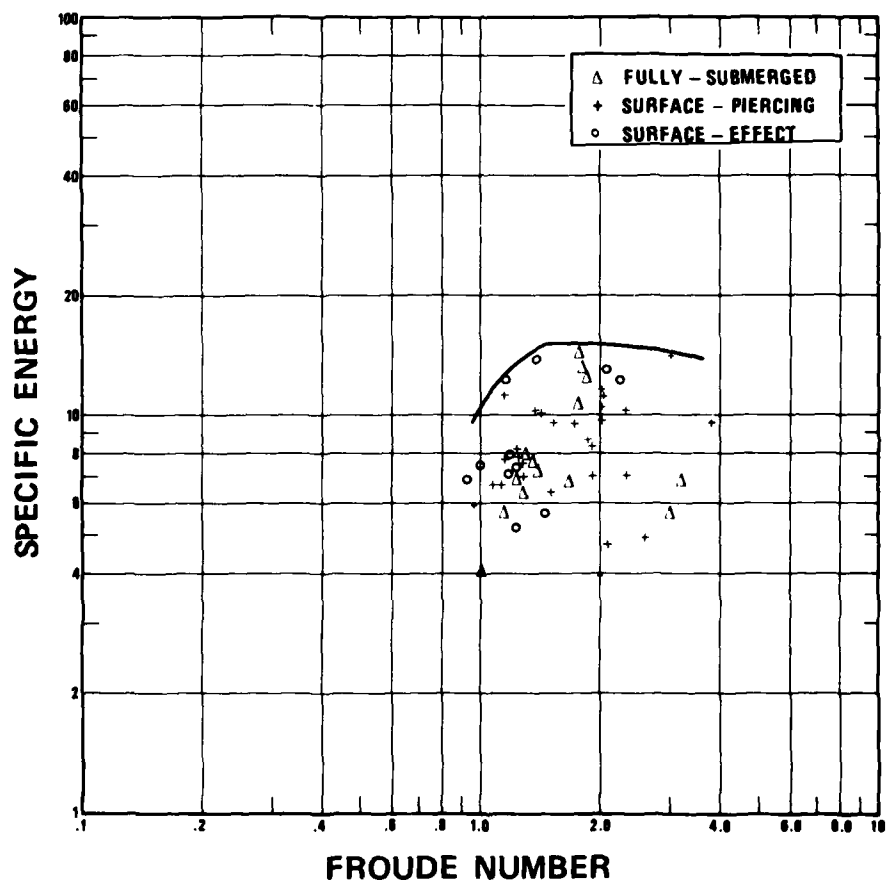


Figure 8 - Hydrofoil

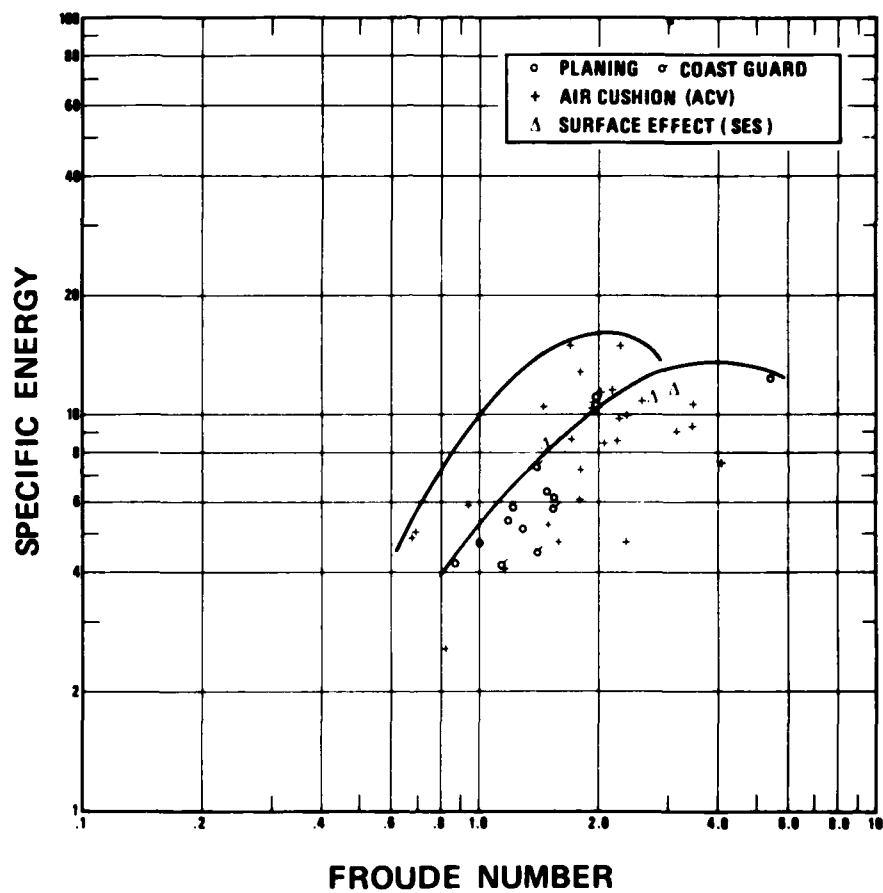


Figure 9 - Air Cushion and Planing

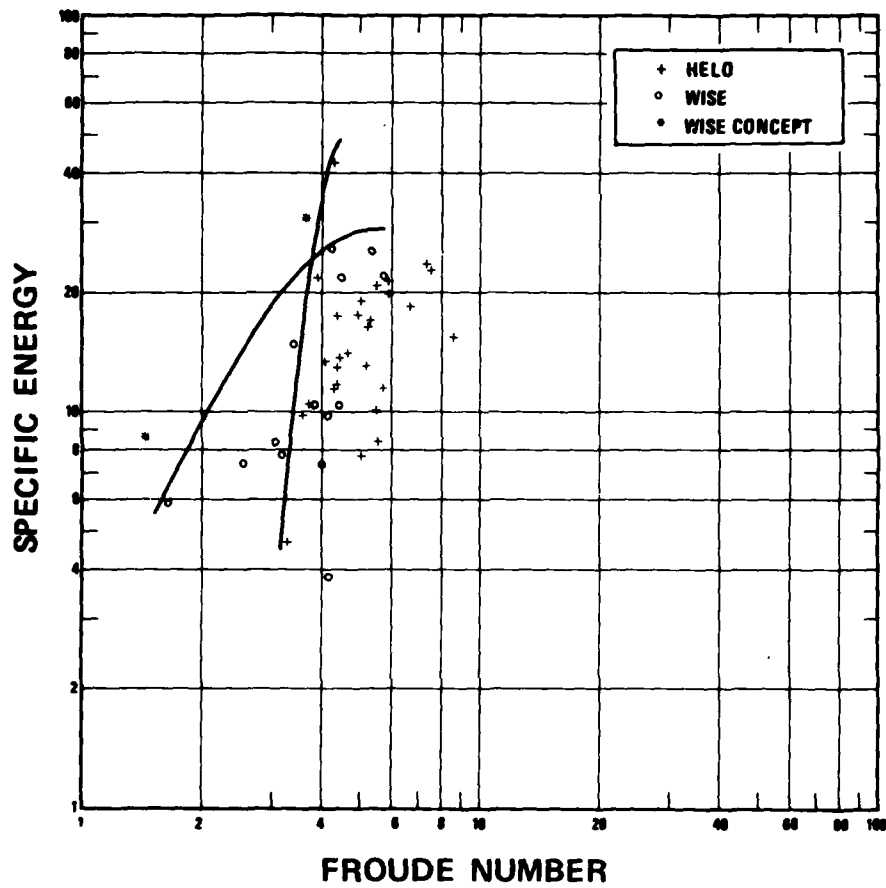


Figure 10 - Helicopter and Wing-in-Surface-Effect

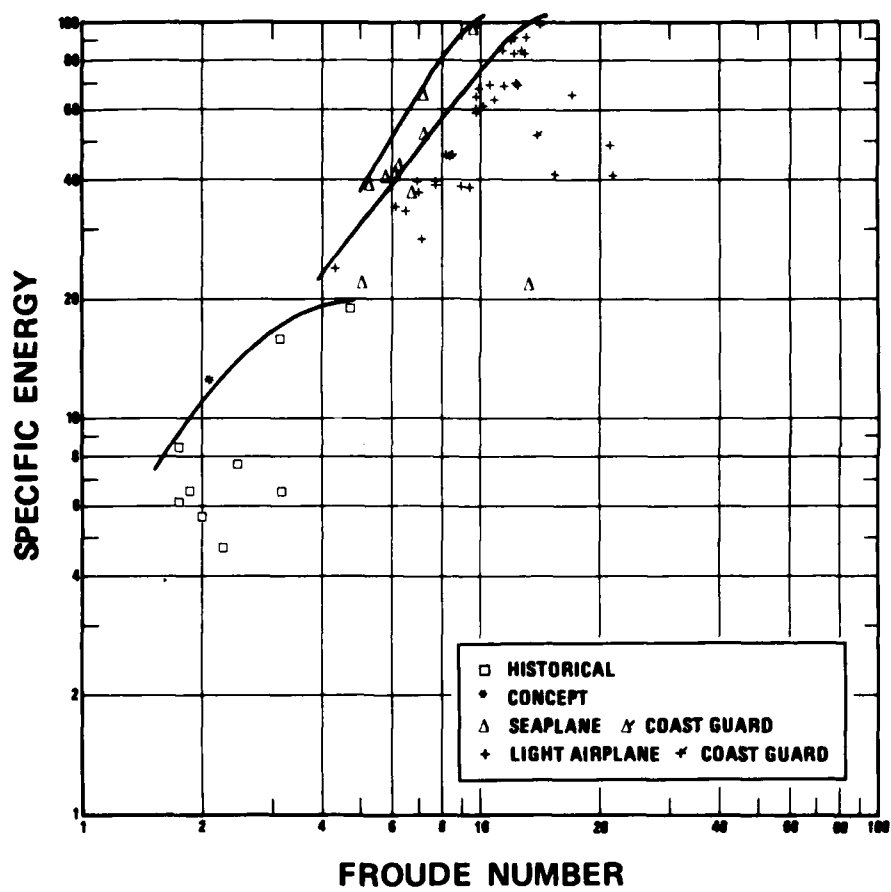


Figure 11 - Seaplane and Light Airplane

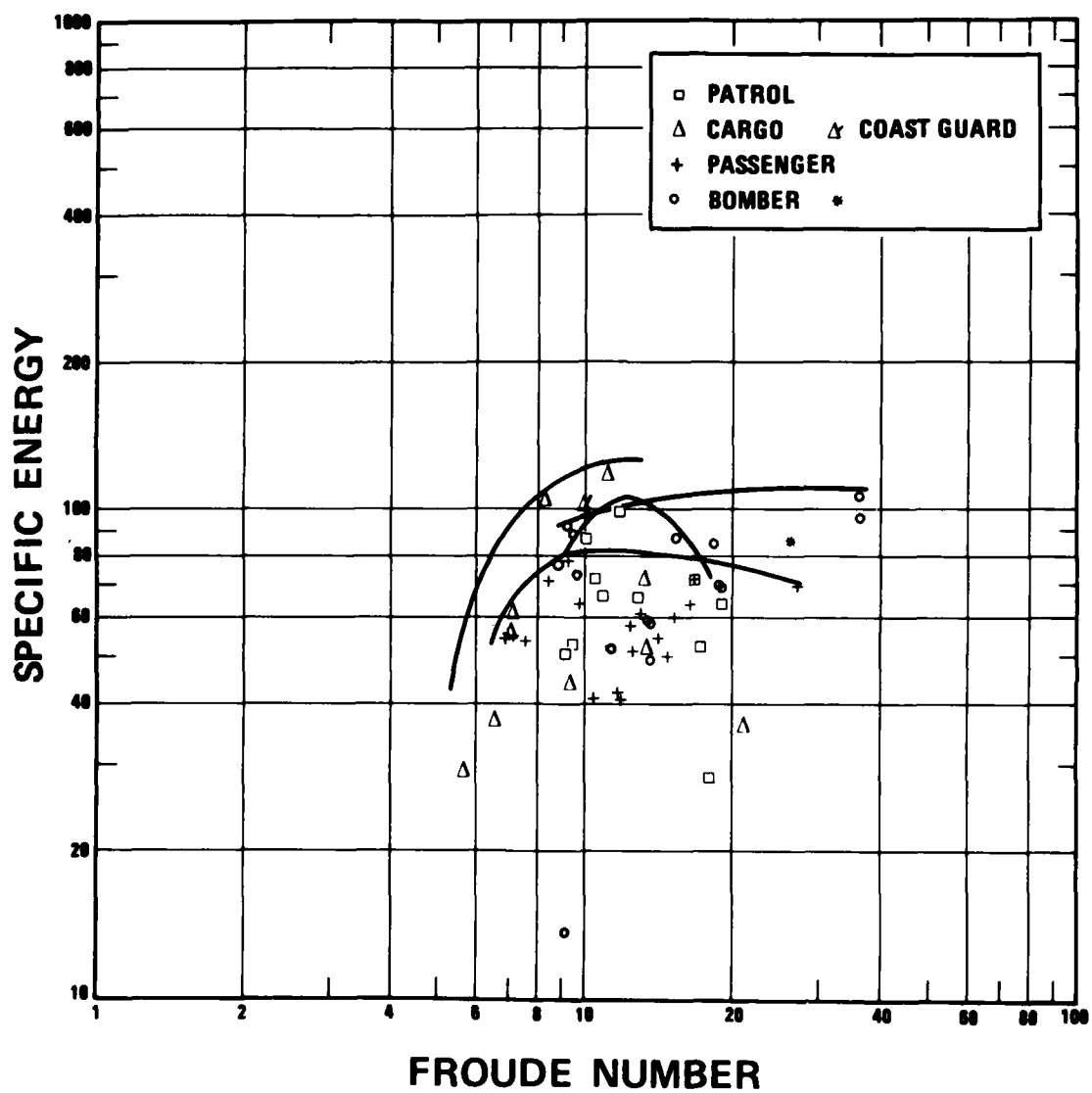


Figure 12 - Transport, Patrol and Bomber

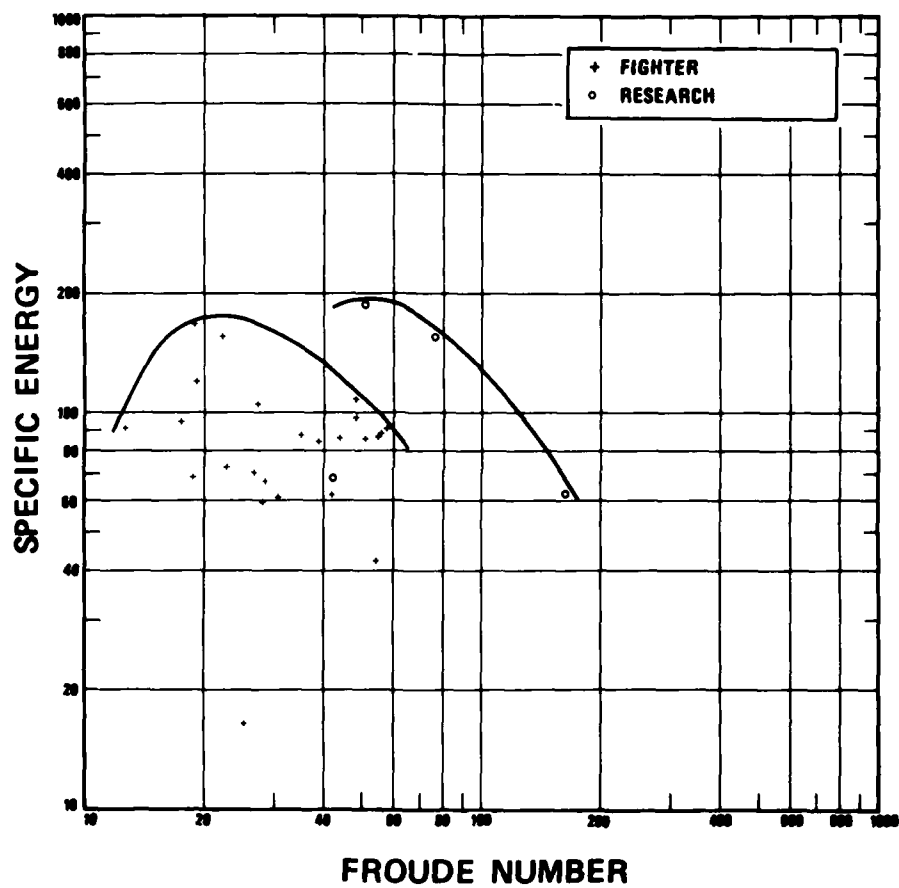


Figure 13 - Fighter and Research

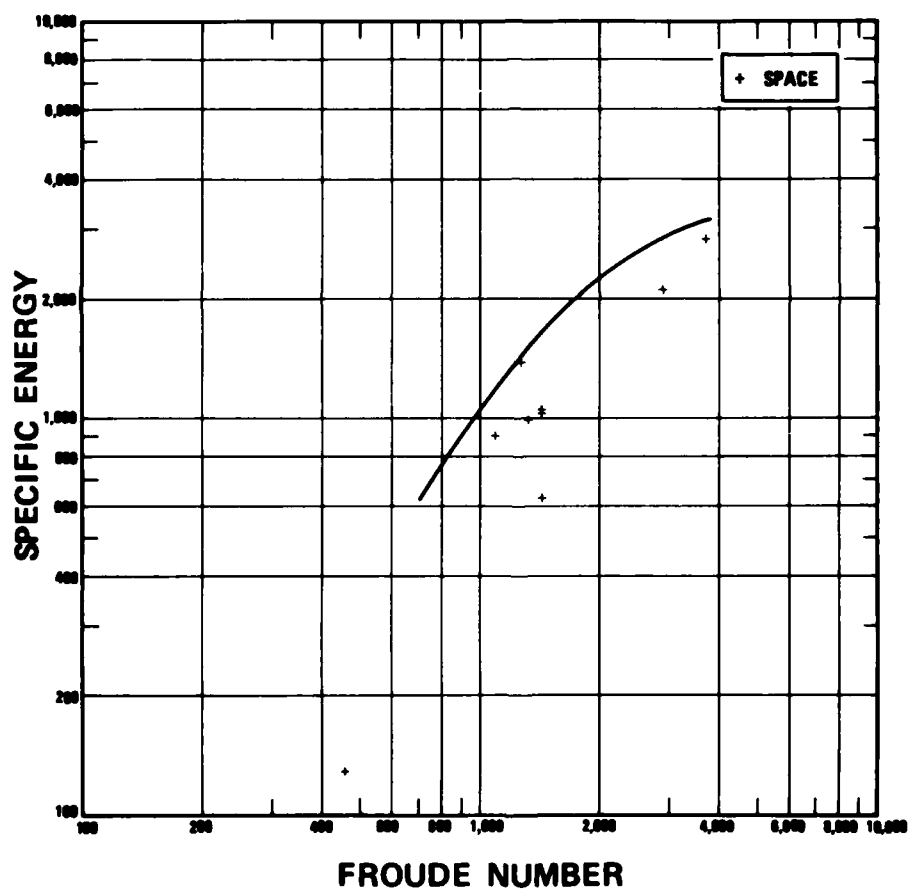


Figure 14 - Space



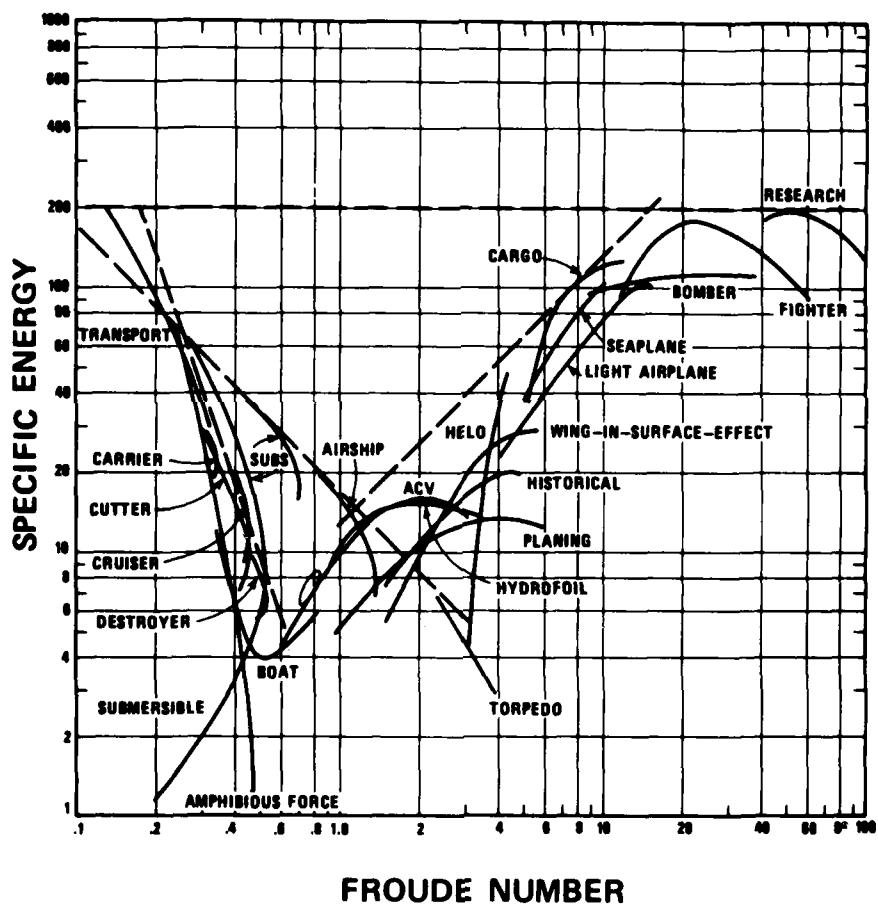


Figure 15 - Summary

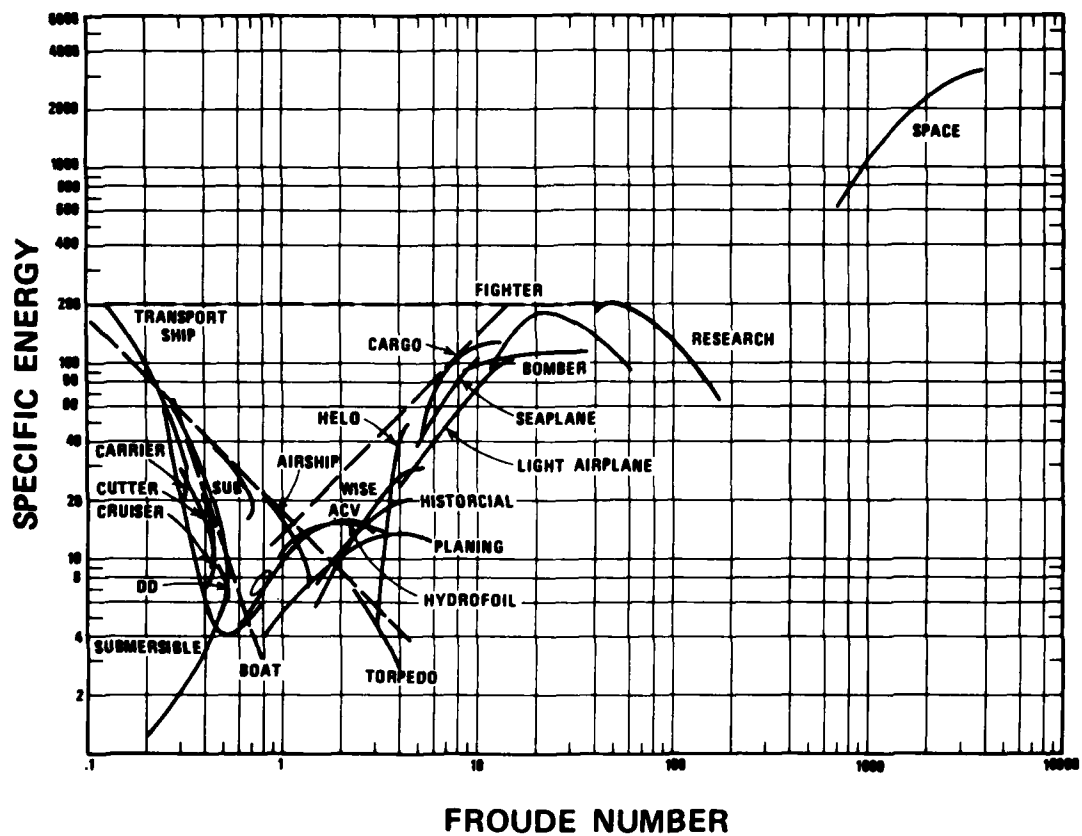


Figure 16 - Summary with Space Vehicles

APPENDIX A

<u>File Designator</u>	<u>Group Name</u>	<u>Page No.</u>
JA1	Submersible	2-4
JA2	Submarine	5-7
JA3	Airship	8-10
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JB2	Small Transport Ship	16-17
JB3	Navy Auxiliary	18-20
JC1	Navy Amphibious	21-23
JC2	Coast Guard Cutter	24-27
JC3	Coast Guard Boat	28-30
JF1	Aircraft Carrier	31-32
JF2	Battleship	32
JF3	Cruiser	33-34
JF4	Destroyer/Frigate	35-36
JF5	Swath	37
JF6	Bibrid Concept	38
JH1	Fully-Submerged Hydrofoil	39-40
JH2	Surface-Effect Hydrofoil	41-42
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JL1	Planing	47-48
JL2	Air Cushion Vehicle	49-52
JL3	Surface Effect Ship	53
JN1	Wing-In-Surface-Effect	54-55
JN2	Helicopter	56-59
JP1	Historical Airplane	60-61
JP2	Seaplane	62-63
JP3	Surveillance/Observation	63
JP4	Light Airplane	64-67
JQ1	Patrol	68-69
JQ2	Cargo Airplane	70-71
JQ3	Passenger Airplane	72-73
JQ4	Bomber	74-75
JS1	Fighter/Interceptor	76-78
JS2	Research	79
JY1	Space	80

# JAI - SUBMERSIBLE

ALUMINAUT	OCEAN IND FEB 68	
LENGTH 51 FT	15.5448 M	
WEIGHT 163520 LB	74172.7 KG	73 LT
SPEED 3.5 KT	1.8018 M/S	5.9115 F/S
POWER 15 HP	11.1855 KW	
THRUST 0 LB	0 KN	
E= 117.17	F= 0.145876	G= 17.0923

ALVIN	OCEAN IND	
LENGTH 22 FT	6.7056 M	
WEIGHT 36960 LB	16765.1 KG	16.5 LT
SPEED 2.5 KT	1.287 M/S	4.2225 F/S
POWER 10 HP	7.457 KW	
THRUST 0 LB	0 KN	
E= 28.3752	F= 0.158646	G= 4.50162

AMERSUB 600	OCEAN IND	
LENGTH 13 FT	3.9624 M	
WEIGHT 3920 LB	1778.11 KG	1.75 LT
SPEED 6 KT	3.0888 M/S	10.134 F/S
POWER 3.5 HP	2.60995 KW	
THRUST 0 LB	0 KN	
E= 20.6365	F= 0.495315	G= 10.2216

ARCHIMEDE	OCEAN IND	
LENGTH 69 FT	21.0312 M	
WEIGHT 136640 LB	61979.9 KG	61 LT
SPEED 2 KT	1.0296 M/S	3.378 F/S
POWER 31 HP	23.1167 KW	
THRUST 0 LB	0 KN	
E= 27.0715	F= 0.071665	G= 1.94008

ASHERAH	OCEAN INDUSTRY	
LENGTH 17 FT	5.1816 M	
WEIGHT 9408 LB	4267.47 KG	4.2 LT
SPEED 3 KT	1.5444 M/S	5.067 F/S
POWER 4 HP	2.9828 KW	
THRUST 0 LB	0 KN	
E= 21.6683	F= 0.21657	G= 4.69271

AUGUSTE PICCARD (PX-8)	OCEAN IND	
LENGTH 93.5 FT	28.4988 M	
WEIGHT 367360 LB	166634. KG	164 LT
SPEED 6 KT	3.0888 M/S	10.134 F/S
POWER 80 HP	59.656 KW	
THRUST 0 LB	0 KN	
E= 84.6097	F= 0.184692	G= 15.6267

BENTHOS V	OCEAN IND	
LENGTH 11.3 FT	3.44424 M	
WEIGHT 47040 LB	21337.3 KG	21 LT
SPEED 3 KT	1.5444 M/S	5.067 F/S
POWER 2 HP	1.4914 KW	
THRUST 0 LB	0 KN	
E= 216.683	F= 0.265634	G= 57.5585

DEEP QUEST	OCEAN IND	
LENGTH 39.83 FT	12.1402 M	
WEIGHT 116480 LB	52835.3 KG	52 LT
SPEED 4.5 KT	2.3166 M/S	7.6005 F/S
POWER 30 HP	22.371 KW	
THRUST 0 LB	0 KN	
E= 53.6549	F= 0.212231	G= 11.3872

DEEP STAR 4000 OCEAN IND			
LENGTH	18 FT	5.4864 M	
WEIGHT	21280 LB	9652.61 KG	9.5 LT
SPEED	3 KT	1.5444 M/S	5.067 F/S
POWER	9 HP	6.7113 KW	
THRUST	0 LB	0 KN	
E=	21.783	F= 0.210468	G= 4.58463
DENISE OCEAN IND/DIVING SAUCER			
LENGTH	9.5 FT	2.8956 M	
WEIGHT	5040 LB	2286.14 KG	2.25 LT
SPEED	1 KT	0.5148 M/S	1.689 F/S
POWER	2 HP	1.4914 KW	
THRUST	0 LB	0 KN	
E=	7.73869	F= 9.65695 E-2	G= 0.747321
DOWB OCEAN IND			
LENGTH	16 FT	4.8768 M	
WEIGHT	14273.3 LB	6474.36 KG	6.372 LT
SPEED	5 KT	2.574 M/S	8.445 F/S
POWER	8 HP	5.9656 KW	
THRUST	0 LB	0 KN	
E=	27.395	F= 0.372059	G= 10.1925
PC-3X (3A) OCEAN IND			
LENGTH	18.5 FT	5.6388 M	
WEIGHT	4789.12 LB	2172.34 KG	2.138 LT
SPEED	4.25 KT	2.1879 M/S	7.17825 F/S
POWER	7 HP	5.2199 KW	
THRUST	0 LB	0 KN	
E=	8.92922	F= 0.294107	G= 2.62614
PC-3B OCEAN IND/PERRY			
LENGTH	22 FT	6.7056 M	
WEIGHT	6160 LB	2794.18 KG	2.75 LT
SPEED	4.5 KT	2.3166 M/S	7.6005 F/S
POWER	7 HP	5.2199 KW	
THRUST	0 LB	0 KN	
E=	12.1608	F= 0.285564	G= 3.47268
NAI'A (PC5C) OCEAN IND			
LENGTH	22 FT	6.7056 M	
WEIGHT	11480 LB	5207.33 KG	5.125 LT
SPEED	3.5 KT	1.8018 M/S	5.9115 F/S
POWER	7.5 HP	5.59275 KW	
THRUST	0 LB	0 KN	
E=	16.4519	F= 0.222105	G= 3.65405
DEEP DIVER OCEAN IND/PERRY-LINK			
LENGTH	23 FT	7.0104 M	
WEIGHT	18480 LB	8382.53 KG	8.25 LT
SPEED	3 KT	1.5444 M/S	5.067 F/S
POWER	16 HP	11.9312 KW	
THRUST	0 LB	0 KN	
E=	10.6407	F= 0.186191	G= 1.9812
AMERSUB 30 OCEAN IND			
LENGTH	30 FT	9.144 M	
WEIGHT	4720 LB	2048.12 KG	3 LT
SPEED	6 KT	3.0888 M/S	10.134 F/S
POWER	11 HP	8.2027 KW	
THRUST	0 LB	0 KN	
E=	11.2563	F= 0.326056	G= 3.67018

STAR I	OCEAN IND/GD	
LENGTH 10.1 FT	3.07848 M	
WEIGHT 2750.72 LB	1247.73 KG	1.228 LT
SPEED 1 KT	0.5148 M/S	1.689 F/S
POWER 0.5 HP	0.37285 KW	
THRUST 0 LB	0 KN	
E= 16.8944	F= 9.36572 E-2	G= 1.58228

STAR II	OCEAN IND/GD	
LENGTH 17.75 FT	5.4102 M	
WEIGHT 10528 LB	4775.5 KG	4.7 LT
SPEED 4.5 KT	2.3166 M/S	7.6005 F/S
POWER 4 HP	2.9828 KW	
THRUST 0 LB	0 KN	
E= 36.3718	F= 0.317918	G= 11.5633

STAR III	OCEAN IND/GD	
LENGTH 24.5 FT	7.4676 M	
WEIGHT 10528 LB	4775.5 KG	4.7 LT
SPEED 4.5 KT	2.3166 M/S	7.6005 F/S
POWER 4 HP	2.9828 KW	
THRUST 0 LB	0 KN	
E= 36.3718	F= 0.270602	G= 9.8423

SUBMARAY	OCEAN IND	
LENGTH 13 FT	3.9624 M	
WEIGHT 3200.96 LB	1451.96 KG	1.429 LT
SPEED 2.5 KT	1.287 M/S	4.2225 F/S
POWER 4 HP	2.9828 KW	
THRUST 0 LB	0 KN	
E= 6.14366	F= 0.206381	G= 1.26794

TRIEST II	OCEAN IND	
LENGTH 76 FT	23.1648 M	
WEIGHT 163520 LB	74172.7 KG	73 LT
SPEED 2 KT	1.0296 M/S	3.378 F/S
POWER 18 HP	13.4226 KW	
THRUST 0 LB	0 KN	
E= 55.795	F= 6.82849 E-2	G= 3.80996

PX-15	OCEAN IND/GRUMMAN	
LENGTH 48.5 FT	14.7828 M	
WEIGHT 291200 LB	132088. KG	130 LT
SPEED 4.5 KT	2.3166 M/S	7.6005 F/S
POWER 100 HP	74.57 KW	
THRUST 0 LB	0 KN	
E= 40.2412	F= 0.192328	G= 7.73952

AUTEC I	OCEAN IND	
LENGTH 26 FT	7.9248 M	
WEIGHT 47040 LB	21337.3 KG	21 LT
SPEED 2 KT	1.0296 M/S	3.378 F/S
POWER 9.5 HP	7.08415 KW	
THRUST 0 LB	0 KN	
E= 30.4117	F= 0.116747	G= 3.55047

# JA2 - SUBMARINE

ALBACORE (AGSS-569)	HEFFNER	
LENGTH 210.5 FT	64.1604 M	
WEIGHT 4114880 LB	1.86651 E+6 KG	1837 LT
SPEED 32.7 KT	16.834 M/S	55.2303 F/S
POWER 14470 HP	10790.3 KW	
THRUST 0 LB	0 KN	
E= 28.5564	F= 0.670847	G= 19.157

SUB 103	CLASSIFIED/IGNORE INPUT DATA	
LENGTH 8459 FT	2578.3 M	
WEIGHT 2352000 LB	1.06687 E+6 KG	1050 LT
SPEED 88 KT	45.3024 M/S	148.632 F/S
POWER 8888 HP	6627.78 KW	
THRUST 0 LB	0 KN	
E= 71.5127	F= 0.28479	G= 20.3661

SUB 121	NWIP I/CLASSIFIED IGNORE DATA	
LENGTH 8165 FT	2488.69 M	
WEIGHT 3814720 LB	1730357 KG	1703 LT
SPEED 88 KT	45.3024 M/S	148.632 F/S
POWER 8888 HP	6627.78 KW	
THRUST 0 LB	0 KN	
E= 115.987	F= 0.289872	G= 33.6213

SUB 137	NWIP I/CLASSIFIED IGNORE DATA	
LENGTH 7630 FT	2325.62 M	
WEIGHT 2602880 LB	1.18067 E+6 KG	1132 LT
SPEED 88 KT	45.3024 M/S	148.632 F/S
POWER 8888 HP	6627.78 KW	
THRUST 0 LB	0 KN	
E= 79.1407	F= 0.299862	G= 23.7313

SUB 135	NWIP I/CLASSIFIED IGNORE DATA	
LENGTH 7145 FT	2177.8 M	
WEIGHT 2497600 LB	1.13291 E+6 KG	1115 LT
SPEED 88 KT	45.3024 M/S	148.632 F/S
POWER 8888 HP	6627.78 KW	
THRUST 0 LB	0 KN	
E= 75.9396	F= 0.309873	G= 23.5316

SUB 105	NWIP I/CLASSIFIED IGNORE DATA	
LENGTH 7145 FT	2177.8 M	
WEIGHT 3321920 LB	1.50682 E+6 KG	1483 LT
SPEED 88 KT	45.3024 M/S	148.632 F/S
POWER 8888 HP	6627.78 KW	
THRUST 0 LB	0 KN	
E= 101.003	F= 0.309873	G= 31.2981

SUB 106	NWIP I/CLASSIFIED IGNORE DATA	
LENGTH 6706 FT	2043.99 M	
WEIGHT 2381120 LB	1.08008 E+6 KG	1063 LT
SPEED 88 KT	45.3024 M/S	148.632 F/S
POWER 8888 HP	6627.78 KW	
THRUST 0 LB	0 KN	
E= 72.3981	F= 0.319855	G= 23.1568

SUB 133	NWIP I/CLASSIFIED IGNORE DATA	
LENGTH 6306 FT	1922.07 M	
WEIGHT 2219840 LB	1.00692 E+6 KG	991 LT
SPEED 88 KT	45.3024 M/S	148.632 F/S
POWER 8888 HP	6627.78 KW	
THRUST 0 LB	0 KN	
E= 67.4943	F= 0.329843	G= 22.2625

SUB 117 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 6306 FT 1922.07 M  
 WEIGHT 2914240 LB 1.3219 E+6 KG 1301 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 88.6076 F= 0.329843 G= 29.2266

SUB 127 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 5940 FT 1810.51 M  
 WEIGHT 2688000 LB 1.21928 E+6 KG 1200 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 81.7287 F= 0.339853 G= 27.7758

SUB 109 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 5606 FT 1708.71 M  
 WEIGHT 1299200 LB 589317. KG 580 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 39.5022 F= 0.349831 G= 13.8191

SUB 111 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 5606 FT 1708.71 M  
 WEIGHT 1391040 LB 630976. KG 621 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 42.2946 F= 0.349831 G= 14.796

SUB 125 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 5606 FT 1708.71 M  
 WEIGHT 1496320 LB 678731. KG 668 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 45.4957 F= 0.349831 G= 15.9158

SUB 113 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 5016 FT 1528.88 M  
 WEIGHT 2009280 LB 911409. KG 897 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 61.0922 F= 0.369833 G= 22.5939

SUB 123 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 3391 FT 1033.58 M  
 WEIGHT 1910720 LB 866703. KG 853 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 58.0955 F= 0.449801 G= 26.1314

SUB 107 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 3245 FT 989.076 M  
 WEIGHT 2291520 LB 1.03943 E+6 KG 1023 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 69.6738 F= 0.459809 G= 32.0366



SUB 115 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 2980 FT 908.304 M  
 WEIGHT 1352960 LB 613703. KG 604 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 41.1368 F= 0.479818 G= 19.7382

SUB 129 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 2980 FT 908.304 M  
 WEIGHT 1612800 LB 731566. KG 720 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 49.0372 F= 0.479818 G= 23.5289

SUB 119 NWIP I/CLASSIFIED IGNORE DATA  
 LENGTH 2747 FT 837.286 M  
 WEIGHT 2078720 LB 942907. KG 928 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 63.2036 F= 0.499753 G= 31.5861

SOVIET VICTOR JFS 73-74  
 LENGTH 285.4 FT 86.9899 M  
 WEIGHT 8064000 LB 3.65783 E+6 KG 3600 LT  
 SPEED 32 KT 16.4736 M/S 54.048 F/S  
 POWER 24000 HP 17896.8 KW  
 THRUST 0 LB 0 KN  
 E= 33.0184 F= 0.5638 G= 18.6158

SOVIET H JFS 68-69/FBM  
 LENGTH 344 FT 104.851 M  
 WEIGHT 9184000 LB 4.16586 E+6 KG 4100 LT  
 SPEED 30 KT 15.444 M/S 50.67 F/S  
 POWER 15000 HP 11185.5 KW  
 THRUST 0 LB 0 KN  
 E= 56.4065 F= 0.481442 G= 27.1564

SOVIET N JFS 68-69/ANT-SUB  
 LENGTH 360 FT 109.728 M  
 WEIGHT 8960000 LB 4064256 KG 4000 LT  
 SPEED 30 KT 15.444 M/S 50.67 F/S  
 POWER 15000 HP 11185.5 KW  
 THRUST 0 LB 0 KN  
 E= 55.0307 F= 0.470621 G= 25.8986

SOVIET G JFS 68-69/FBM  
 LENGTH 320 FT 97.536 M  
 WEIGHT 5264000 LB 2.38775 E+6 KG 2350 LT  
 SPEED 17.6 KT 9.06048 M/S 29.7264 F/S  
 POWER 6000 HP 4474.2 KW  
 THRUST 0 LB 0 KN  
 E= 47.4181 F= 0.292846 G= 13.8862

SOVIET Z JFS 68-69/FBM/SURFACED  
 LENGTH 295.2 FT 89.977 M  
 WEIGHT 4704000 LB 2.13373 E+6 KG 2100 LT  
 SPEED 22 KT 11.3256 M/S 37.158 F/S  
 POWER 10000 HP 7457 KW  
 THRUST 0 LB 0 KN  
 E= 31.7802 F= 0.381124 G= 12.1122

SOVIET F JFS 68-69/ATTACK/SURFACED  
 LENGTH 300 FT 91.44 M  
 WEIGHT 4480000 LB 2032128 KG 2000 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 10000 HP 7457 KW  
 THRUST 0 LB 0 KN  
 E= 27.5153 F= 0.343693 G= 9.45684

# JA3 - AIRSHIP

LZ-10 ZEPPELIN/FLT INTL 31 OCT 74  
 LENGTH 459 FT 139.903 M  
 WEIGHT 45530 LB 20652.4 KG 20.3259 LT  
 SPEED 40.8 KT 21.0038 M/S 68.9112 F/S  
 POWER 450 HP 335.565 KW  
 THRUST 0 LB 0 KN  
 E= 12.6769 F= 0.566834 G= 7.18568

SL-1 SCHUTTE-LANZ/FLT INTL 5 DEC 74  
 LENGTH 426 FT 129.845 M  
 WEIGHT 52500 LB 23814 KG 23.4375 LT  
 SPEED 38.3 KT 19.7168 M/S 64.6887 F/S  
 POWER 480 HP 357.936 KW  
 THRUST 0 LB 0 KN  
 E= 12.8642 F= 0.552326 G= 7.10525

SL-2 SCHUTTE-LANZ/FLT INTL 2 JAN 75  
 LENGTH 472 FT 143.866 M  
 WEIGHT 63900 LB 28985. KG 28.5268 LT  
 SPEED 47.6 KT 24.5045 M/S 80.3964 F/S  
 POWER 720 HP 536.904 KW  
 THRUST 0 LB 0 KN  
 E= 12.9731 F= 0.652135 G= 8.46019

LZ-24 Z.IX ZEPPELIN/FLT INTL 6 FEB 75  
 LENGTH 518 FT 157.886 M  
 WEIGHT 57540 LB 26100.1 KG 25.6875 LT  
 SPEED 45.5 KT 23.4234 M/S 76.8495 F/S  
 POWER 630 HP 469.791 KW  
 THRUST 0 LB 0 KN  
 E= 12.7617 F= 0.595043 G= 7.59374

LZ-38 ZEPPELIN/FLT INTL 6 MAR 75  
 LENGTH 536 FT 163.373 M  
 WEIGHT 81570 LB 37000.2 KG 36.4152 LT  
 SPEED 51.9 KT 26.7181 M/S 87.6591 F/S  
 POWER 840 HP 626.388 KW  
 THRUST 0 LB 0 KN  
 E= 15.477 F= 0.667247 G= 10.327

L 62 ZEPPELIN/FLT INTL 27 MAR 75  
 LENGTH 650 FT 198.12 M  
 WEIGHT 140873 LB 63900. KG 62.8897 LT  
 SPEED 55.7 KT 28.6744 M/S 94.0773 F/S  
 POWER 1440 HP 1073.81 KW  
 THRUST 0 LB 0 KN  
 E= 16.7335 F= 0.65028 G= 10.8815

LZ 59 ZEPPELIN/FLT INTL 17 APR 75  
 LENGTH 743 FT 226.466 M  
 WEIGHT 175265 LB 79500.2 KG 78.2433 LT  
 SPEED 55.5 KT 28.5714 M/S 93.7395 F/S  
 POWER 1200 HP 894.84 KW  
 THRUST 0 LB 0 KN  
 E= 24.8928 F= 0.606039 G= 15.086

R 34 BEARDMORE/FLT INTL 15 MAY 75  
 LENGTH 643 FT 195.986 M  
 WEIGHT 141980 LB 64402.1 KG 63.3839 LT  
 SPEED 52.1 KT 26.8211 M/S 87.9969 F/S  
 POWER 1250 HP 932.125 KW  
 THRUST 0 LB 0 KN  
 E= 18.1728 F= 0.611553 G= 11.1136

LZ 127 GRAF ZEPPELIN/FLT INTL 12 JUN 75  
 LENGTH 776 FT 236.525 M  
 WEIGHT 229890 LB 104278. KG 102.629 LT  
 SPEED 69.1 KT 35.5727 M/S 116.71 F/S  
 POWER 2650 HP 1976.11 KW  
 THRUST 0 LB 0 KN  
 E= 18.4085 F= 0.738327 G= 13.5915

ZSG-2/-3/-4 NAVY/JAWAC 60-61  
 LENGTH 267 FT 81.3816 M  
 WEIGHT 34413 LB 15609.7 KG 15.3629 LT  
 SPEED 70 KT 36.036 M/S 118.23 F/S  
 POWER 1100 HP 820.27 KW  
 THRUST 0 LB 0 KN  
 E= 6.72504 F= 1.2751 G= 8.5751

ZS2G-1 NAVY/JAWAC  
 LENGTH 285 FT 86.868 M  
 WEIGHT 42445 LB 19253.1 KG 18.9487 LT  
 SPEED 74 KT 38.0952 M/S 124.986 F/S  
 POWER 1600 HP 1193.12 KW  
 THRUST 0 LB 0 KN  
 E= 6.02844 F= 1.3047 G= 7.86532

ZPG-1 NAVY  
 LENGTH 324.4 FT 98.8771 M  
 WEIGHT 57137 LB 25917.3 KG 25.5076 LT  
 SPEED 74 KT 38.0952 M/S 124.986 F/S  
 POWER 1600 HP 1193.12 KW  
 THRUST 0 LB 0 KN  
 E= 8.11514 F= 1.22291 G= 9.92405

ZPG-2/-2W NAVY/JAWAC  
 LENGTH 343 FT 104.546 M  
 WEIGHT 63667 LB 28879.4 KG 28.4228 LT  
 SPEED 74 KT 38.0952 M/S 124.986 F/S  
 POWER 1600 HP 1193.12 KW  
 THRUST 0 LB 0 KN  
 E= 9.0426 F= 1.18929 G= 10.7542

ZPG-3W NAVY/VW 30 SEP 74  
 LENGTH 433 FT 131.978 M  
 WEIGHT 97950 LB 44430.1 KG 43.7277 LT  
 SPEED 69.5 KT 35.7786 M/S 117.385 F/S  
 POWER 3050 HP 2274.39 KW  
 THRUST 0 LB 0 KN  
 E= 6.85419 F= 0.994129 G= 6.81395

AKRON-MACON NAVY ZRS-4/-5/SMITH  
 LENGTH 785 FT 239.268 M  
 WEIGHT 447300 LB 202895. KG 199.687 LT  
 SPEED 75.6 KT 38.9189 M/S 127.688 F/S  
 POWER 4480 HP 3340.74 KW  
 THRUST 0 LB 0 KN  
 E= 23.1798 F= 0.803135 G= 18.6165

LZ 129/LZ 130 HINDENBERG/GRAF Z. II/CONSENSUS OF DATA

LENGTH	803.8 FT	244.998 M	
WEIGHT	461667 LB	209412. KG	206.101 LT
SPEED	67 KT	34.4916 M/S	113.163 F/S
POWER	4600 HP	3430.22 KW	
THRUST	0 LB	0 KN	
E=	20.6497	F= 0.7034	G= 14.525

LZ 126 LOS ANGELES/ZR 3/CONSENSUS

LENGTH	658.3 FT	200.65 M	
WEIGHT	161291 LB	73161.6 KG	72.0049 LT
SPEED	63.5 KT	32.6898 M/S	107.252 F/S
POWER	2000 HP	1491.4 KW	
THRUST	0 LB	0 KN	
E=	15.7261	F= 0.736654	G= 11.5847

R 100 CONSENSUS

LENGTH	709 FT	216.103 M	
WEIGHT	326500 LB	148100. KG	145.759 LT
SPEED	69.5 KT	35.7786 M/S	117.385 F/S
POWER	3600 HP	2684.52 KW	
THRUST	0 LB	0 KN	
E=	19.3568	F= 0.776897	G= 15.0382

R101 FLT INTL 10 JUL 74

LENGTH	724 FT	220.675 M	
WEIGHT	326500 LB	148100. KG	145.759 LT
SPEED	65 KT	33.462 M/S	109.785 F/S
POWER	3250 HP	2423.52 KW	
THRUST	0 LB	0 KN	
E=	20.053	F= 0.719028	G= 14.4187

ZRN\* NAVY DIESEL CONCEPT/CLEMENTS

LENGTH	650 FT	198.12 M	
WEIGHT	192000 LB	87091.2 KG	85.7143 LT
SPEED	65.1 KT	33.5135 M/S	109.954 F/S
POWER	3000 HP	2237.1 KW	
THRUST	0 LB	0 KN	
E=	12.7946	F= 0.760022	G= 9.7242

ZRCV\* AIRCR CARRIER CONCEPT/CLEMENTS

LENGTH	897 FT	273.406 M	
WEIGHT	592000 LB	268531. KG	264.286 LT
SPEED	65.1 KT	33.5135 M/S	109.954 F/S
POWER	6000 HP	4474.2 KW	
THRUST	0 LB	0 KN	
E=	19.7251	F= 0.646973	G= 12.7616

ZRCC(N)\* TRANSPORT CONCEPT/CLEMENTS

LENGTH	1000 FT	304.8 M	
WEIGHT	1360000 LB	616896 KG	607.143 LT
SPEED	86.8 KT	44.6846 M/S	146.605 F/S
POWER	20000 HP	14914 KW	
THRUST	0 LB	0 KN	
E=	18.1257	F= 0.816999	G= 14.8087

ZRCVN\* AIRCR CARRIER CONCEPT/CLEMENTS

LENGTH	1000 FT	304.8 M	
WEIGHT	3910000 LB	1773576 KG	1745.54 LT
SPEED	86.8 KT	44.6846 M/S	146.605 F/S
POWER	85000 HP	63384.5 KW	
THRUST	0 LB	0 KN	
E=	12.2615	F= 0.816999	G= 10.0177

ZPG-X \* GOODYEAR DES CONCEPT/GDTR

LENGTH	405 FT	123.444 M	
WEIGHT	109500 LB	49669.2 KG	48.8839 LT
SPEED	88 KT	45.3024 M/S	148.632 F/S
POWER	3432 HP	2559.24 KW	
THRUST	0 LB	0 KN	
E=	8.62217	F= 1.30154	G= 11.2221

AD-500 \* AIRSP DEV LTD/CONSTRN/BROCHURE

LENGTH	164 FT	49.9872 M	
WEIGHT	10360 LB	4699.3 KG	4.625 LT
SPEED	62 KT	31.9176 M/S	104.718 F/S
POWER	400 HP	298.28 KW	
THRUST	0 LB	0 KN	
E=	4.93127	F= 1.44102	G= 7.10608

JA4 - TORPEDO

MARK 1 NWIP I/ORDHAC/IGNORE INPUT DATA-CLASSIFIED

LENGTH	49.09 FT	14.9626 M	
WEIGHT	613.536 LB	278.3 KG	0.2739 LT
SPEED	88 KT	45.3024 M/S	148.632 F/S
POWER	0 HP	0 KW	
THRUST	800 LB	3.55872 KN	
E=	0.76692	F= 3.73842	G= 2.86707

MARK 2 NWIP I/ORDHAC/IGNORE INPUT DATA

LENGTH	75.29 FT	22.9484 M	
WEIGHT	984.032 LB	446.357 KG	0.4393 LT
SPEED	88 KT	45.3024 M/S	148.632 F/S
POWER	0 HP	0 KW	
THRUST	800 LB	3.55872 KN	
E=	1.23004	F= 3.01867	G= 3.71309

MARK 3 NWIP I/ORDHAC/IGNORE INPUT DATA

LENGTH	176.9 FT	53.9191 M	
WEIGHT	1936.03 LB	878.184 KG	0.8643 LT
SPEED	88 KT	45.3024 M/S	148.632 F/S
POWER	0 HP	0 KW	
THRUST	800 LB	3.55872 KN	
E=	2.42004	F= 1.96934	G= 4.76588

MARK 4 NWIP I/ORDHAC/IGNORE INPUT DATA

LENGTH	85.14 FT	25.9507 M	
WEIGHT	1359.9 LB	616.852 KG	0.6071 LT
SPEED	88 KT	45.3024 M/S	148.632 F/S
POWER	0 HP	0 KW	
THRUST	800 LB	3.55872 KN	
E=	1.69988	F= 2.83869	G= 4.82543

MARK 5 NWIP I/ORDHAC/IGNORE INPUT DATA

LENGTH	99.28 FT	30.2605 M	
WEIGHT	1031.97 LB	468.101 KG	0.4607 LT
SPEED	88 KT	45.3024 M/S	148.632 F/S
POWER	0 HP	0 KW	
THRUST	800 LB	3.55872 KN	
E=	1.28996	F= 2.62878	G= 3.39102

MARK 6 NWIP I/ORDHAC/IGNORE INPUT DATA

LENGTH	119.2 FT	36.3322 M	
WEIGHT	2072 LB	939.859 KG	0.925 LT
SPEED	88 KT	45.3024 M/S	148.632 F/S
POWER	0 HP	0 KW	
THRUST	800 LB	3.55872 KN	
E=	2.59	F= 2.39909	G= 6.21364

JBI - LARGE TRANSPORT SHIP

CEDROS TANKER/JAP SHPB  
 LENGTH 978.9 FT 298.369 M  
 WEIGHT 3.9424 E+8 LB 1.78827 E+8 KG 176000 LT  
 SPEED 16.2 KT 8.33976 M/S 27.3618 F/S  
 POWER 27190 HP 20275.6 KW  
 THRUST 0 LB 0 KN  
 E= 721.329 F= 0.154116 G= 111.168

ENERGY ENTERPRISE TANKER/M E LOG  
 LENGTH 1312.5 FT 400.05 M  
 WEIGHT 1.1153 E+9 LB 5.05898 E+8 KG 497900 LT  
 SPEED 21.2 KT 10.9138 M/S 35.8068 F/S  
 POWER 120000 HP 89484 KW  
 THRUST 0 LB 0 KN  
 E= 605.078 F= 0.174176 G= 105.39

ANN'S TANKER/M E LOG  
 LENGTH 1218 FT 371.246 M  
 WEIGHT 1.04608 E+9 LB 4.74502 E+8 KG 467000 LT  
 SPEED 16 KT 8.2368 M/S 27.024 F/S  
 POWER 45000 HP 33556.5 KW  
 THRUST 0 LB 0 KN  
 E= 1142.19 F= 0.136458 G= 155.861

SEA SAINT TANKER/M E LOG  
 LENGTH 1196 FT 364.541 M  
 WEIGHT 9.50387 E+8 LB 4.31096 E+8 KG 424280 LT  
 SPEED 15.5 KT 7.9794 M/S 26.1795 F/S  
 POWER 40000 HP 29828 KW  
 THRUST 0 LB 0 KN  
 E= 1130.94 F= 0.133404 G= 150.871

CORONADO TANKER/M E LOG  
 LENGTH 687.5 FT 209.55 M  
 WEIGHT 105862400 LB 4.80192 E+7 KG 47260 LT  
 SPEED 16 KT 8.2368 M/S 27.024 F/S  
 POWER 15000 HP 11185.5 KW  
 THRUST 0 LB 0 KN  
 E= 346.767 F= 0.181629 G= 62.9829

GOLDEN DOLPHIN TANKER/M E LOG  
 LENGTH 891 FT 271.577 M  
 WEIGHT 2.3921 E+8 LB 108505475 KG 106790 LT  
 SPEED 16.5 KT 8.4942 M/S 27.8685 F/S  
 POWER 24500 HP 18269.7 KW  
 THRUST 0 LB 0 KN  
 E= 494.725 F= 0.164531 G= 81.3973

SEIKO MARU TANKER/M E LOG  
 LENGTH 888 FT 270.662 M  
 WEIGHT 3.69443 E+8 LB 1.67579 E+8 KG 164930 LT  
 SPEED 16.8 KT 8.64864 M/S 28.3752 F/S  
 POWER 28000 HP 20879.6 KW  
 THRUST 0 LB 0 KN  
 E= 680.716 F= 0.167805 G= 114.227

KEIYO MARU TANKER/M E LOG  
 LENGTH 1025 FT 312.42 M  
 WEIGHT 5.61635 E+8 LB 2.54758 E+8 KG 250730 LT  
 SPEED 15.6 KT 8.03088 M/S 26.3484 F/S  
 POWER 36000 HP 26845.2 KW  
 THRUST 0 LB 0 KN  
 E= 747.383 F= 0.145032 G= 108.395

ARCO ANCHORAGE TANKER/M E LOG  
 LENGTH 920 FT 280.416 M  
 WEIGHT 2.9712 E+8 LB 1.34774 E+8 KG 132643 LT  
 SPEED 15.9 KT 8.18532 M/S 26.8551 F/S  
 POWER 26000 HP 19388.2 KW  
 THRUST 0 LB 0 KN  
 E= 557.986 F= 0.156029 G= 87.0619

ARTEAGA TANKER/M E LOG  
 LENGTH 1186 FT 361.493 M  
 WEIGHT 7.96051 E+8 LB 3.61089 E+8 KG 355380 LT  
 SPEED 15 KT 7.722 M/S 25.335 F/S  
 POWER 37400 HP 27889.2 KW  
 THRUST 0 LB 0 KN  
 E= 980.455 F= 0.129643 G= 127.11

GLOBTOK TOKYO TANKER/M E LOG  
 LENGTH 1295 FT 394.716 M  
 WEIGHT 1.19175 E+9 LB 5.40577 E+8 KG 532030 LT  
 SPEED 14.7 KT 7.56756 M/S 24.8283 F/S  
 POWER 45000 HP 33556.5 KW  
 THRUST 0 LB 0 KN  
 E= 1195.52 F= 0.121586 G= 145.358

RAS MAERSK TANKER/M E LOG  
 LENGTH 1186 FT 361.493 M  
 WEIGHT 7.03472 E+8 LB 3.19095 E+8 KG 314050 LT  
 SPEED 16 KT 8.2368 M/S 27.024 F/S  
 POWER 32000 HP 23862.4 KW  
 THRUST 0 LB 0 KN  
 E= 1080.15 F= 0.138286 G= 149.37

TEXACO SWEDEN TANKER/M E LOG  
 LENGTH 1164 FT 354.787 M  
 WEIGHT 6.29888 E+8 LB 2.85717 E+8 KG 281200 LT  
 SPEED 16.1 KT 8.28828 M/S 27.1929 F/S  
 POWER 32000 HP 23862.4 KW  
 THRUST 0 LB 0 KN  
 E= 973.209 F= 0.140459 G= 136.696

ALVA BAY TANKER/M E LOG  
 LENGTH 1139 FT 347.167 M  
 WEIGHT 5.65488 E+8 LB 2.56505 E+8 KG 252450 LT  
 SPEED 16 KT 8.2368 M/S 27.024 F/S  
 POWER 32450 HP 24198. KW  
 THRUST 0 LB 0 KN  
 E= 856.24 F= 0.141111 G= 120.825

ATLANTIC BARON TANKER/MAR REP  
 LENGTH 1146 FT 349.301 M  
 WEIGHT 6.26976 E+8 LB 2.84396 E+8 KG 279900 LT  
 SPEED 15.6 KT 8.03088 M/S 26.3484 F/S  
 POWER 32000 HP 23862.4 KW  
 THRUST 0 LB 0 KN  
 E= 938.626 F= 0.137162 G= 128.744

MEDIUM TANKER (1955)/BOEING  
 LENGTH 677 FT 206.35 M  
 WEIGHT 111238400 LB 5.04577 E+7 KG 49660 LT  
 SPEED 18 KT 9.2664 M/S 30.402 F/S  
 POWER 20000 HP 14914 KW  
 THRUST 0 LB 0 KN  
 E= 307.443 F= 0.205911 G= 63.3059

ESSO ATLANTIC TANKER/ABS 78/MAR REP  
 LENGTH 1334 FT 406.603 M  
 WEIGHT 1.30038 E+9 LB 5.89852 E+8 KG 580526 LT  
 SPEED 15.9 KT 8.18532 M/S 26.8551 F/S  
 POWER 45000 HP 33556.5 KW  
 THRUST 0 LB 0 KN  
 E= 1410.98 F= 0.129575 G= 182.828

CONT ELBE MARU CONTAINER SHIP/JAP SHPB  
 LENGTH 882 FT 268.834 M  
 WEIGHT 132764800 LB 6.02221 E+7 KG 59270 LT  
 SPEED 31 KT 15.9588 M/S 52.359 F/S  
 POWER 84600 HP 63086.2 KW  
 THRUST 0 LB 0 KN  
 E= 149.397 F= 0.310691 G= 46.4163

CONT ATLANTIC CROWN CONTAINER/JAP SHPB  
 LENGTH 697 FT 212.446 M  
 WEIGHT 59808000 LB 2.71289 E+7 KG 26700 LT  
 SPEED 24 KT 12.3552 M/S 40.536 F/S  
 POWER 29590 HP 22065.3 KW  
 THRUST 0 LB 0 KN  
 E= 148.968 F= 0.270581 G= 40.3078



NISSEI MARU TANKER/MAR REP  
 LENGTH 1295 FT 394.716 M  
 WEIGHT 1.17533 E+9 LB 5.33129 E+8 KG 524700 LT  
 SPEED 14.3 KT 7.36164 M/S 24.1527 F/S  
 POWER 45000 HP 33556.5 KW  
 THRUST 0 LB 0 KN  
 E= 1146.96 F= 0.118278 G= 135.66

ESSO KAWASAKI TANKER/MAR REP  
 LENGTH 1163 FT 354.482 M  
 WEIGHT 7.392 E+8 LB 3.35301 E+8 KG 330000 LT  
 SPEED 15.9 KT 8.18532 M/S 26.8551 F/S  
 POWER 36000 HP 26845.2 KW  
 THRUST 0 LB 0 KN  
 E= 1002.59 F= 0.138774 G= 139.134

UNIVERSE MARINER TANKER/MAR REP  
 LENGTH 1154 FT 351.739 M  
 WEIGHT 6.62592 E+8 LB 3.00552 E+8 KG 295800 LT  
 SPEED 16 KT 8.2368 M/S 27.024 F/S  
 POWER 40000 HP 29828 KW  
 THRUST 0 LB 0 KN  
 E= 813.904 F= 0.140191 G= 114.102

BRITISH RESPECT TANKER/MAR REP  
 LENGTH 1148 FT 349.91 M  
 WEIGHT 6.6528 E+8 LB 3.01771 E+8 KG 297000 LT  
 SPEED 16.2 KT 8.33976 M/S 27.3618 F/S  
 POWER 36000 HP 26845.2 KW  
 THRUST 0 LB 0 KN  
 E= 919.356 F= 0.142313 G= 130.837

WORLD ADMIRAL TANKER/MAR REP  
 LENGTH 1059 FT 322.783 M  
 WEIGHT 5.8464 E+8 LB 2.65193 E+8 KG 261000 LT  
 SPEED 16.5 KT 8.4942 M/S 27.8685 F/S  
 POWER 36000 HP 26845.2 KW  
 THRUST 0 LB 0 KN  
 E= 822.881 F= 0.150917 G= 124.187

TEXACO ITALIA TANKER/MAR REP  
 LENGTH 1152 FT 351.13 M  
 WEIGHT 6.496 E+8 LB 2.94659 E+8 KG 290000 LT  
 SPEED 15.8 KT 8.13384 M/S 26.6862 F/S  
 POWER 33530 HP 25003.3 KW  
 THRUST 0 LB 0 KN  
 E= 940.019 F= 0.138558 G= 130.247

MANHATTAN TANKER/ N62/BOEING  
 LENGTH 892 FT 271.882 M  
 WEIGHT 3.07032 E+8 LB 1.3927 E+8 KG 137068 LT  
 SPEED 17.7 KT 9.11196 M/S 29.8953 F/S  
 POWER 39000 HP 29082.3 KW  
 THRUST 0 LB 0 KN  
 E= 427.917 F= 0.176398 G= 75.4835

JB2 - SMALL TRANSPORT SHIP

C3-S-A2 DRY CARGO/BOEING/1942  
 LENGTH 462 FT 140.818 M  
 WEIGHT 39457600 LB 1.7898 E+7 KG 17615 LT  
 SPEED 16.5 KT 8.4942 M/S 27.8685 F/S  
 POWER 8500 HP 6338.45 KW  
 THRUST 0 LB 0 KN  
 E= 235.214 F= 0.228489 G= 53.7437

C1A BOEING/DRY CARGO/1942  
 LENGTH 390 FT 118.872 M  
 WEIGHT 24830400 LB 1.12631 E+7 KG 11085 LT  
 SPEED 14 KT 7.2072 M/S 23.646 F/S  
 POWER 4000 HP 2982.8 KW  
 THRUST 0 LB 0 KN  
 E= 266.882 F= 0.211007 G= 56.314

C2-S-AJ1 BOEING/DRY CARGO/1943  
 LENGTH 435 FT 132.588 M  
 WEIGHT 33476800 LB 1.51851 E+7 KG 14945 LT  
 SPEED 15.5 KT 7.9794 M/S 26.1795 F/S  
 POWER 6000 HP 4474.2 KW  
 THRUST 0 LB 0 KN  
 E= 265.578 F= 0.221202 G= 58.7462

VC-2-S-AP3 BOEING/DRY CARGO/1944  
 LENGTH 437 FT 133.198 M  
 WEIGHT 34070400 LB 1.54543 E+7 KG 15210 LT  
 SPEED 16.5 KT 8.4942 M/S 27.8685 F/S  
 POWER 8500 HP 6338.45 KW  
 THRUST 0 LB 0 KN  
 E= 203.1 F= 0.234933 G= 47.7149

C1-M-AV1 BOEING/DRY CARGO/1944  
 LENGTH 324 FT 98.7552 M  
 WEIGHT 18513600 LB 8397769 KG 8265 LT  
 SPEED 10.5 KT 5.4054 M/S 17.7345 F/S  
 POWER 1700 HP 1267.69 KW  
 THRUST 0 LB 0 KN  
 E= 351.154 F= 0.173627 G= 60.9701

C4-S-1A		BOEING/DRY CARGO/1952	
LENGTH	528 FT	160.934 M	
WEIGHT	47259520 LB	2.14369 E+7 KG	21098 LT
SPEED	20.3 KT	10.4504 M/S	34.2867 F/S
POWER	17500 HP	13049.7 KW	
THRUST	0 LB	0 KN	
E=	168.35	F= 0.262955	G= 44.2685
C3-ST-14A		BOEING/DRY CARGO/1958	
LENGTH	465 FT	141.732 M	
WEIGHT	40960640 LB	1.85797 E+7 KG	13286 LT
SPEED	18 KT	9.2664 M/S	30.402 F/S
POWER	11220 HP	8366.75 KW	
THRUST	0 LB	0 KN	
E=	201.796	F= 0.248455	G= 50.1373
C4-S-57A		BOEING/DRY CARGO/1963	
LENGTH	529 FT	161.239 M	
WEIGHT	47158720 LB	2.13912 E+7 KG	21053 LT
SPEED	20.5 KT	10.5534 M/S	34.6245 F/S
POWER	16500 HP	12304.1 KW	
THRUST	0 LB	0 KN	
E=	179.928	F= 0.265294	G= 47.7339
C4-ST-67A		BOEING/DRY CARGO/1964	
LENGTH	499.5 FT	152.248 M	
WEIGHT	48608000 LB	2.20486 E+7 KG	21700 LT
SPEED	20 KT	10.296 M/S	33.78 F/S
POWER	17500 HP	13049.7 KW	
THRUST	0 LB	0 KN	
E=	170.595	F= 0.266357	G= 45.4392
T2-SE-A1		BOEING/TANKER/1942	
LENGTH	510 FT	155.448 M	
WEIGHT	48715520 LB	22097360 KG	21748 LT
SPEED	14.5 KT	7.4646 M/S	24.4905 F/S
POWER	6000 HP	4474.2 KW	
THRUST	0 LB	0 KN	
E=	361.536	F= 0.191111	G= 69.0933

JB3 - NAVY AUXILIARY

AE 21 SURIBACHI/AMMO SHIP/JFS 73-74  
 LENGTH 512 FT 156.058 M  
 WEIGHT 39200000 LB 17781120 KG 17500 LT  
 SPEED 20.6 KT 10.6049 M/S 34.7934 F/S  
 POWER 16000 HP 11931.2 KW  
 THRUST 0 LB 0 KN  
 E= 154.989 F= 0.270978 G= 41.9985

AE 12 WRANGELL/AMMO SHIP/JFS 73-74  
 LENGTH 459.2 FT 139.964 M  
 WEIGHT 34260800 LB 1.55407 E+7 KG 15295 LT  
 SPEED 16.4 KT 8.44272 M/S 27.6996 F/S  
 POWER 6000 HP 4474.2 KW  
 THRUST 0 LB 0 KN  
 E= 287.579 F= 0.227795 G= 65.5091

AF 58 RIGEL/STORE SHIP/JFS 73-74  
 LENGTH 502 FT 153.01 M  
 WEIGHT 34809600 LB 1.57896 E+7 KG 15540 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 16000 HP 11931.2 KW  
 THRUST 0 LB 0 KN  
 E= 133.621 F= 0.265693 G= 35.5022

AO 143 NEOSHO/OILER/JFS 73-74  
 LENGTH 655 FT 199.644 M  
 WEIGHT 89600000 LB 40642560 KG 40000 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 28000 HP 20879.6 KW  
 THRUST 0 LB 0 KN  
 E= 196.538 F= 0.232601 G= 45.7149

AO 51 ASHTABULA/JUMBOIZED/JFS 73-74  
 LENGTH 644 FT 196.291 M  
 WEIGHT 77840000 LB 35308224 KG 34750 LT  
 SPEED 18 KT 9.2664 M/S 30.402 F/S  
 POWER 13500 HP 10067. KW  
 THRUST 0 LB 0 KN  
 E= 318.719 F= 0.211121 G= 67.2883

AO 36 KENENBEC/OILER/JFS 73-74  
 LENGTH 501.4 FT 152.827 M  
 WEIGHT 48339200 LB 2.19267 E+7 KG 21580 LT  
 SPEED 16.7 KT 8.59716 M/S 28.2063 F/S  
 POWER 12000 HP 8948.4 KW  
 THRUST 0 LB 0 KN  
 E= 206.586 F= 0.221986 G= 45.8593

ADI CLASSIFIED DATA/DD TENDER/NWIP II  
 LENGTH 12032 FT 3667.35 M  
 WEIGHT 6847680 LB 3.10611 E+6 KG 3057 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 208.204 F= 0.23879 G= 49.717

AD2 CLASSIFIED DATA/DD TENDER/NWIP II  
 LENGTH 11774 FT 3588.72 M  
 WEIGHT 7185920 LB 3.25953 E+6 KG 3208 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 218.488 F= 0.241392 G= 52.7412

AD3 CLASSIFIED DATA/DD TENDER/NWIP II  
 LENGTH 12891 FT 3929.18 M  
 WEIGHT 6728960 LB 3.05226 E+6 KG 3004 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 204.594 F= 0.230697 G= 47.1992

AD4 CLASSIFIED DATA/DD TENDER/NWIP II  
 LENGTH 10324 FT 3146.76 M  
 WEIGHT 5019840 LB 2.277 E+6 KG 2241 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 152.628 F= 0.257787 G= 39.3456

AX5 CLASSIFIED AUX/NWIP II  
 LENGTH 9014 FT 2747.47 M  
 WEIGHT 4632320 LB 2.10122 E+6 KG 2068 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 140.846 F= 0.275883 G= 38.857

AX6 CLASSIFIED AUX/NWIP II  
 LENGTH 8885 FT 2708.15 M  
 WEIGHT 3812480 LB 1.72934 E+6 KG 1702 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 115.919 F= 0.277879 G= 32.2113

AX7 CLASSIFIED AUX/NWIP II  
 LENGTH 7286 FT 2220.77 M  
 WEIGHT 3519040 LB 1.59624 E+6 KG 1571 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 106.997 F= 0.30686 G= 32.8329

AX8 CLASSIFIED AUX/NWIP II  
 LENGTH 11534 FT 3515.56 M  
 WEIGHT 5664960 LB 2.56963 E+6 KG 2529 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 172.243 F= 0.24389 G= 42.0085

AX9 CLASSIFIED AUX/NWIP II  
 LENGTH 10900 FT 3322.32 M  
 WEIGHT 5667200 LB 2.57064 E+6 KG 2530 LT  
 SPEED 88 KT 45.3024 M/S 148.632 F/S  
 POWER 8888 HP 6627.78 KW  
 THRUST 0 LB 0 KN  
 E= 172.311 F= 0.250883 G= 43.23

ASR 21 PIGEON CATAMARAN/JFS 73-74  
 LENGTH 251 FT 76.5048 M  
 WEIGHT 9408000 LB 4.26747 E+6 KG 4200 LT  
 SPEED 15 KT 7.722 M/S 25.335 F/S  
 POWER 6000 HP 4474.2 KW  
 THRUST 0 LB 0 KN  
 E= 72.2278 F= 0.28181 G= 20.3545

AGOR 16 HAYES CATAMARAN/JFS 73-74  
 LENGTH 246.5 FT 75.1332 M  
 WEIGHT 6899200 LB 3.12948 E+6 KG 3080 LT  
 SPEED 15 KT 7.722 M/S 25.335 F/S  
 POWER 5400 HP 4026.78 KW  
 THRUST 0 LB 0 KN  
 E= 58.8523 F= 0.28437 G= 16.7358

AGOR 14 MELVILLE OCEANOGRAPHIC RES/JFS 73-74  
 LENGTH 244.9 FT 74.6455 M  
 WEIGHT 4659200 LB 2.11341 E+6 KG 2080 LT  
 SPEED 12 KT 6.1776 M/S 20.268 F/S  
 POWER 2500 HP 1864.25 KW  
 THRUST 0 LB 0 KN  
 E= 68.6783 F= 0.228238 G= 15.675

T-AGS 26 BENT SURVEY/JFS 73-74  
 LENGTH 285.3 FT 86.9594 M  
 WEIGHT 5729920 LB 2.59909 E+6 KG 2558 LT  
 SPEED 14 KT 7.2072 M/S 23.646 F/S  
 POWER 3600 HP 2684.52 KW  
 THRUST 0 LB 0 KN  
 E= 68.4291 F= 0.246706 G= 16.8818

# JC1 - NAVY AMPHIBIOUS

LCC 7 MOUNT MCKINLEY/JFS 73-74  
 LENGTH 495.3 FT 150.967 M  
 WEIGHT 38134400 LB 1.27618 E+7 KG 12560 LT  
 SPEED 16.4 KT 8.44272 M/S 27.6996 F/S  
 POWER 6000 HP 4474.2 KW  
 THRUST 0 LB 0 KN  
 E= 236.155 F= 0.219337 G= 51.7975

LCC 19 BLUE RIDGE/JFS 73-74  
 LENGTH 620 FT 188.976 M  
 WEIGHT 43209600 LB 1.95999 E+7 KG 19290 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 22000 HP 16405.4 KW  
 THRUST 0 LB 0 KN  
 E= 120.63 F= 0.239076 G= 28.8397

LHA 1 TARAWA/JFS 73-74  
 LENGTH 820 FT 249.936 M  
 WEIGHT 88032000 LB 3.99313 E+7 KG 39300 LT  
 SPEED 24 KT 12.3552 M/S 40.536 F/S  
 POWER 70000 HP 52199 KW  
 THRUST 0 LB 0 KN  
 E= 92.6874 F= 0.249463 G= 23.1221

LPH 2 IWO JIMA/JFS 73-74  
 LENGTH 592 FT 180.442 M  
 WEIGHT 40992000 LB 1.8594 E+7 KG 18300 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 23000 HP 17151.1 KW  
 THRUST 0 LB 0 KN  
 E= 109.463 F= 0.244664 G= 26.7818

LKA 113 CHARLESTON/JFS 73-74/V PLUS  
 LENGTH 575.5 FT 175.412 M  
 WEIGHT 46368000 LB 2.10325 E+7 KG 20700 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 22000 HP 16405.4 KW  
 THRUST 0 LB 0 KN  
 E= 129.447 F= 0.248147 G= 32.1219

LKA 103 RANKIN/JFS 73-74  
 LENGTH 459.2 FT 139.964 M  
 WEIGHT 31718400 LB 1.43875 E+7 KG 14160 LT  
 SPEED 16.5 KT 8.4942 M/S 27.8685 F/S  
 POWER 6000 HP 4474.2 KW  
 THRUST 0 LB 0 KN  
 E= 267.862 F= 0.229184 G= 61.3897

LPA 248 PAUL REVERE/JFS 73-74  
 LENGTH 563.5 FT 171.755 M  
 WEIGHT 37717120 LB 1.71085 E+7 KG 16838 LT  
 SPEED 22 KT 11.3256 M/S 37.158 F/S  
 POWER 22000 HP 16405.4 KW  
 THRUST 0 LB 0 KN  
 E= 115.826 F= 0.275853 G= 31.9509

LPA 194 HASKELL/JFS 73-74  
 LENGTH 455 FT 138.684 M  
 WEIGHT 23452800 LB 1.06382 E+7 KG 10470 LT  
 SPEED 17.7 KT 9.11196 M/S 29.8953 F/S  
 POWER 8500 HP 6338.45 KW  
 THRUST 0 LB 0 KN  
 E= 149.974 F= 0.246984 G= 37.0412

LPA 44 BAYFIELD/JFS 73-74  
 LENGTH 492 FT 149.962 M  
 WEIGHT 34048000 LB 1.54442 E+7 KG 15200 LT  
 SPEED 18.4 KT 9.47232 M/S 31.0776 F/S  
 POWER 8500 HP 6338.45 KW  
 THRUST 0 LB 0 KN  
 E= 226.338 F= 0.246909 G= 55.8849

LPD 4 AUSTIN/JFS 73-74  
 LENGTH 570 FT 173.736 M  
 WEIGHT 37856000 LB 1.71715 E+7 KG 16900 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 24000 HP 17896.8 KW  
 THRUST 0 LB 0 KN  
 E= 96.8769 F= 0.249341 G= 24.1554

LSD 36 ANCHORAGE/JFS 73-74  
 LENGTH 553.3 FT 168.646 M  
 WEIGHT 30688000 LB 1.39201 E+7 KG 13700 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 24000 HP 17896.8 KW  
 THRUST 0 LB 0 KN  
 E= 78.5334 F= 0.253076 G= 19.8749

LSD 28 THOMASTON/JFS 73-74  
 LENGTH 510 FT 155.448 M  
 WEIGHT 25244800 LB 1.1451 E+7 KG 11270 LT  
 SPEED 22.5 KT 11.583 M/S 38.0025 F/S  
 POWER 24000 HP 17896.8 KW  
 THRUST 0 LB 0 KN  
 E= 72.6792 F= 0.296551 G= 21.5531

LSD 13 CASA GRANDE/JFS 73-74  
 LENGTH 475.4 FT 144.902 M  
 WEIGHT 21000000 LB 9525600 KG 9375 LT  
 SPEED 15.4 KT 7.92792 M/S 26.0106 F/S  
 POWER 7000 HP 5219.9 KW  
 THRUST 0 LB 0 KN  
 E= 141.876 F= 0.210229 G= 29.8265

LST 1179 NEWPORT/JFS 73-74  
 LENGTH 522.3 FT 159.197 M  
 WEIGHT 18686080 LB 8.47601 E+6 KG 8342 LT  
 SPEED 20 KT 10.296 M/S 33.78 F/S  
 POWER 16000 HP 11931.2 KW  
 THRUST 0 LB 0 KN  
 E= 71.7291 F= 0.260478 G= 18.6839

LST 1173 SUFFOLK COUNTY/JFS 73-74  
 LENGTH 445 FT 135.636 M  
 WEIGHT 17920000 LB 8128512 KG 8000 LT  
 SPEED 17.5 KT 9.009 M/S 29.5575 F/S  
 POWER 14400 HP 10738.1 KW  
 THRUST 0 LB 0 KN  
 E= 66.8776 F= 0.246922 G= 16.5135

LST 1153 TALBOT COUNTY/JFS 73-74  
 LENGTH 382 FT 116.434 M  
 WEIGHT 13440000 LB 6096384 KG 6000 LT  
 SPEED 14 KT 7.2072 M/S 23.646 F/S  
 POWER 6000 HP 4474.2 KW  
 THRUST 0 LB 0 KN  
 E= 96.3037 F= 0.213205 G= 20.5325



LST 525 511-1172 SERIES/JFS 73-74  
 LENGTH 328 FT 99.9744 M  
 WEIGHT 9139200 LB 4.14554 E+6 KG 4080 LT  
 SPEED 11.6 KT 5.97168 M/S 19.5924 F/S  
 POWER 1700 HP 1267.69 KW  
 THRUST 0 LB 0 KN  
 E= 191.507 F= 0.190644 G= 36.5096

LFR 1 CARRONADE/JFS 73-74  
 LENGTH 245 FT 74.676 M  
 WEIGHT 3360000 LB 1524096 KG 1500 LT  
 SPEED 15 KT 7.722 M/S 25.335 F/S  
 POWER 3100 HP 2311.67 KW  
 THRUST 0 LB 0 KN  
 E= 49.927 F= 0.28524 G= 14.2412

LFR 40 BIG BLACK RIVER/JFS 73-74  
 LENGTH 203.5 FT 62.0268 M  
 WEIGHT 2428160 LB 1.10141 E+6 KG 1084 LT  
 SPEED 12.6 KT 6.48648 M/S 21.2814 F/S  
 POWER 2800 HP 2087.96 KW  
 THRUST 0 LB 0 KN  
 E= 33.555 F= 0.2629 G= 8.82159

LCU 1610 UTIL LAND CR/JFS 73-74  
 LENGTH 134.9 FT 41.1175 M  
 WEIGHT 840000 LB 381024 KG 375 LT  
 SPEED 11 KT 5.6628 M/S 18.579 F/S  
 POWER 1000 HP 745.7 KW  
 THRUST 0 LB 0 KN  
 E= 28.3752 F= 0.281896 G= 7.99885

LCU 1466 UTIL LAND CR/JFS 73-74  
 LENGTH 119 FT 36.2712 M  
 WEIGHT 806400 LB 365783. KG 360 LT  
 SPEED 10 KT 5.148 M/S 16.89 F/S  
 POWER 670 HP 499.619 KW  
 THRUST 0 LB 0 KN  
 E= 36.9609 F= 0.272853 G= 10.0849

LCU 501 UTIL LAND CR/JFS 73-74  
 LENGTH 119 FT 36.2712 M  
 WEIGHT 716800 LB 325140. KG 320 LT  
 SPEED 10 KT 5.148 M/S 16.89 F/S  
 POWER 675 HP 503.347 KW  
 THRUST 0 LB 0 KN  
 E= 32.6108 F= 0.272853 G= 8.89794

LCM 8 MECH LAND CR/JFS 73-74  
 LENGTH 73.7 FT 22.4638 M  
 WEIGHT 257600 LB 116847. KG 115 LT  
 SPEED 9 KT 4.6332 M/S 15.201 F/S  
 POWER 650 HP 484.705 KW  
 THRUST 0 LB 0 KN  
 E= 10.9532 F= 0.31204 G= 3.41785

LCVP LC VEH PERS/JFS 73-74  
 LENGTH 35.8 FT 10.9118 M  
 WEIGHT 30240 LB 13716.9 KG 13.5 LT  
 SPEED 9 KT 4.6332 M/S 15.201 F/S  
 POWER 325 HP 242.353 KW  
 THRUST 0 LB 0 KN  
 E= 2.57163 F= 0.447716 G= 1.15136

HYDROSPHERE DANDINI/INFORMAL REPORT  
 LENGTH 7.08 FT 2.15798 M  
 WEIGHT 940.8 LB 426.747 KG 0.42 LT  
 SPEED 3.97 KT 2.04376 M/S 6.70533 F/S  
 POWER 2.8 HP 2.08796 KW  
 THRUST 0 LB 0 KN  
 E= 4.09635 F= 0.444095 G= 1.81917

JC2 - COAST GUARD CUTTER

WHEC 378 HAMILTON/HULLS 715-723/CG SHIP  
 LENGTH 378 FT 115.214 M  
 WEIGHT 6832000 LB 3.099 E+6 KG 3050 LT  
 SPEED 29 KT 14.9292 M/S 48.981 F/S  
 POWER 26000 HP 19388.2 KW  
 THRUST 0 LB 0 KN  
 E= 23.4013 F= 0.44397 G= 10.3895

WHEC 327 DUANE/HULLS 31-37/CG SHIP  
 LENGTH 327 FT 99.6696 M  
 WEIGHT 5949440 LB 2698666 KG 2656 LT  
 SPEED 19.8 KT 10.193 M/S 33.4422 F/S  
 POWER 6200 HP 4623.34 KW  
 THRUST 0 LB 0 KN  
 E= 58.3467 F= 0.325907 G= 19.0156

WHEC 311 UNIMAK(379)/CG SHIP JFS 68-69  
 LENGTH 311 FT 94.7928 M  
 WEIGHT 6272000 LB 2.84498 E+6 KG 2800 LT  
 SPEED 19 KT 9.7812 M/S 32.091 F/S  
 POWER 7000 HP 5219.9 KW  
 THRUST 0 LB 0 KN  
 E= 52.2792 F= 0.320682 G= 16.765

WMEC 270\* DESIGN/BROCHURE DATA  
 LENGTH 270 FT 82.296 M  
 WEIGHT 3857280 LB 1.74966 E+6 KG 1722 LT  
 SPEED 19.5 KT 10.0386 M/S 32.9355 F/S  
 POWER 7000 HP 5219.9 KW  
 THRUST 0 LB 0 KN  
 E= 32.9978 F= 0.353227 G= 11.6557

WMEC 230 STORIS (38)/CG SHIP  
 LENGTH 230 FT 70.104 M  
 WEIGHT 4312000 LB 1.95592 E+6 KG 1925 LT  
 SPEED 14 KT 7.2072 M/S 23.646 F/S  
 POWER 1800 HP 1342.26 KW  
 THRUST 0 LB 0 KN  
 E= 102.991 F= 0.274768 G= 28.2987

WMEC 213 ACUSHNET (167)/CG SHIP  
 LENGTH 213 FT 64.9224 M  
 WEIGHT 3908800 LB 1.77303 E+6 KG 1745 LT  
 SPEED 15.5 KT 7.9794 M/S 26.1795 F/S  
 POWER 3000 HP 2237.1 KW  
 THRUST 0 LB 0 KN  
 E= 62.0184 F= 0.316114 G= 19.6049

WHEC 210A HULLS 615-619/CG SHIP  
 LENGTH 211 FT 64.3128 M  
 WEIGHT 2172800 LB 985582. KG 970 LT  
 SPEED 18 KT 9.2664 M/S 30.402 F/S  
 POWER 5000 HP 3728.5 KW  
 THRUST 0 LB 0 KN  
 E= 24.0209 F= 0.368836 G= 8.85977

WMEC 205 CHEROKEE (165)/CG SHIP  
 LENGTH 205 FT 62.484 M  
 WEIGHT 3877440 LB 1.75881 E+6 KG 1731 LT  
 SPEED 16.2 KT 8.33976 M/S 27.3618 F/S  
 POWER 3000 HP 2237.1 KW  
 THRUST 0 LB 0 KN  
 E= 64.2992 F= 0.336775 G= 21.6544

WMEC ARGO HULLS 103/105/116/JFS 68-69  
 LENGTH 165 FT 50.292 M  
 WEIGHT 828800 LB 375944. KG 370 LT  
 SPEED 14 KT 7.2072 M/S 23.646 F/S  
 POWER 1340 HP 999.238 KW  
 THRUST 0 LB 0 KN  
 E= 26.5913 F= 0.324405 G= 8.62636

WMEC 143 MODOC (194)/CG SHIP  
 LENGTH 143 FT 43.5864 M  
 WEIGHT 1926400 LB 873815. KG 860 LT  
 SPEED 13.5 KT 6.9498 M/S 22.8015 F/S  
 POWER 1500 HP 1118.55 KW  
 THRUST 0 LB 0 KN  
 E= 53.2422 F= 0.336022 G= 17.8905

WMEC ACTIVE HULLS 126-150/JFS 68-69  
 LENGTH 125 FT 38.1 M  
 WEIGHT 649600 LB 294659. KG 290 LT  
 SPEED 13 KT 6.6924 M/S 21.957 F/S  
 POWER 800 HP 596.56 KW  
 THRUST 0 LB 0 KN  
 E= 32.4165 F= 0.346091 G= 11.2191

WAGB 310 GLACIER ICEBREAKER/CG SHIP  
 LENGTH 310 FT 94.488 M  
 WEIGHT 18925760 LB 8.58472 E+6 KG 8449 LT  
 SPEED 17.6 KT 9.06048 M/S 29.7264 F/S  
 POWER 21000 HP 15659.7 KW  
 THRUST 0 LB 0 KN  
 E= 48.7095 F= 0.297532 G= 14.4926

WAGB 399 POLAR SEA (STAR)/CG SHIP  
 LENGTH 399 FT 121.615 M  
 WEIGHT 27074880 LB 1.22812 E+7 KG 12087 LT  
 SPEED 18 KT 9.2664 M/S 30.402 F/S  
 POWER 60000 HP 44742 KW  
 THRUST 0 LB 0 KN  
 E= 24.9433 F= 0.268218 G= 6.69025

WAGB 290 MACKINAW (83)/CG SHIP  
 LENGTH 290 FT 88.392 M  
 WEIGHT 11764480 LB 5.33637 E+6 KG 5252 LT  
 SPEED 18.7 KT 9.62676 M/S 31.5843 F/S  
 POWER 10000 HP 7457 KW  
 THRUST 0 LB 0 KN  
 E= 67.5587 F= 0.326847 G= 22.0814

WAGB 269 BURTON ISLAND (WIND)/CG SHIP  
 LENGTH 269 FT 81.9912 M  
 WEIGHT 14593600 LB 6.61966 E+6 KG 6515 LT  
 SPEED 16 KT 8.2368 M/S 27.024 F/S  
 POWER 10000 HP 7457 KW  
 THRUST 0 LB 0 KN  
 E= 71.705 F= 0.290366 G= 20.8207

EAGLE WIX 295/TRAINING BARQUE (327)CGSHIP  
 LENGTH 295 FT 89.916 M  
 WEIGHT 3996160 LB 1.81266 E+6 KG 1784 LT  
 SPEED 10.5 KT 5.4054 M/S 17.7345 F/S  
 POWER 700 HP 521.99 KW  
 THRUST 0 LB 0 KN  
 E= 184.078 F= 0.181962 G= 33.4951

ACUSHNET WAT OCEAN TUG/JFS 68-69  
 LENGTH 207 FT 63.0936 M  
 WEIGHT 4356800 LB 1.97624 E+6 KG 1945 LT  
 SPEED 13 KT 6.6924 M/S 21.957 F/S  
 POWER 3000 HP 2237.1 KW  
 THRUST 0 LB 0 KN  
 E= 57.9771 F= 0.268943 G= 15.5925

AVOYEL WAT OCEAN TUG/JFS 68-69  
 LENGTH 195 FT 59.436 M  
 WEIGHT 2620800 LB 1.18879 E+6 KG 1170 LT  
 SPEED 16 KT 8.2368 M/S 27.024 F/S  
 POWER 3000 HP 2237.1 KW  
 THRUST 0 LB 0 KN  
 E= 42.9239 F= 0.341039 G= 14.6387

WLB HEATHER SEAGOING TENDER/JFS 68-69  
 LENGTH 188.7 FT 57.5158 M  
 WEIGHT 2800000 LB 1270080 KG 1250 LT  
 SPEED 12 KT 6.1776 M/S 20.268 F/S  
 POWER 1200 HP 894.84 KW  
 THRUST 0 LB 0 KN  
 E= 85.9855 F= 0.260014 G= 22.3574

WAGO 180 EVERGREEN OCEANOGRAPHIC/CG SHIP  
 LENGTH 180 FT 54.864 M  
 WEIGHT 2296000 LB 1.04147 E+6 KG 1025 LT  
 SPEED 12.9 KT 6.64092 M/S 21.7881 F/S  
 POWER 1000 HP 745.7 KW  
 THRUST 0 LB 0 KN  
 E= 90.9554 F= 0.28619 G= 26.0306

WLB 180A LAUREL SEAGOING BUOY TENDER/CG SHIP  
 LENGTH 180 FT 54.864 M  
 WEIGHT 2296000 LB 1.04147 E+6 KG 1025 LT  
 SPEED 12.8 KT 6.58944 M/S 21.6192 F/S  
 POWER 1000 HP 745.7 KW  
 THRUST 0 LB 0 KN  
 E= 90.2503 F= 0.283972 G= 25.6286

WLB 180B BUTTWOOD/FASTEST IN CLASS/CG SHIP  
 LENGTH 180 FT 54.864 M  
 WEIGHT 2296000 LB 1.04147 E+6 KG 1025 LT  
 SPEED 15 KT 7.722 M/S 25.335 F/S  
 POWER 1800 HP 1342.26 KW  
 THRUST 0 LB 0 KN  
 E= 58.7567 F= 0.33278 G= 19.553

WLB 180C SUNDEW/FASTEST IN CLASS/CG SHIP  
 LENGTH 180 FT 54.864 M  
 WEIGHT 2296000 LB 1.04147 E+6 KG 1025 LT  
 SPEED 15 KT 7.722 M/S 25.335 F/S  
 POWER 1800 HP 1342.26 KW  
 THRUST 0 LB 0 KN  
 E= 58.7567 F= 0.33278 G= 19.553

WLM 175 COASTAL BUOY TENDER FIR/CG SHIP  
 LENGTH 175 FT 53.34 M  
 WEIGHT 2170560 LB 984566. KG 969 LT  
 SPEED 12 KT 6.1776 M/S 20.268 F/S  
 POWER 1350 HP 1006.69 KW  
 THRUST 0 LB 0 KN  
 E= 59.2497 F= 0.27 G= 15.9974

WLM 157 RED CG SHIP  
 LENGTH 157 FT 47.8536 M  
 WEIGHT 1146880 LB 520225. KG 512 LT  
 SPEED 12.8 KT 6.58944 M/S 21.6192 F/S  
 POWER 1800 HP 1342.26 KW  
 THRUST 0 LB 0 KN  
 E= 25.0451 F= 0.304062 G= 7.61525

WLM 133 WHITE CG SHIP  
 LENGTH 133 FT 40.5384 M  
 WEIGHT 1344000 LB 609638. KG 600 LT  
 SPEED 9.8 KT 5.04504 M/S 16.5522 F/S  
 POWER 600 HP 447.42 KW  
 THRUST 0 LB 0 KN  
 E= 67.4126 F= 0.252931 G= 17.0507

WLI HICKORY LG INLAND TENDER/JFS 68-69  
 LENGTH 131.2 FT 39.9898 M  
 WEIGHT 896000 LB 406426. KG 400 LT  
 SPEED 12 KT 6.1776 M/S 20.268 F/S  
 POWER 500 HP 372.85 KW  
 THRUST 0 LB 0 KN  
 E= 66.0368 F= 0.311829 G= 20.5922

WLV LIGHTSHIP NANTUCKET 612/CG SHIP  
 LENGTH 128 FT 39.0144 M  
 WEIGHT 1359680 LB 616751. KG 607 LT  
 SPEED 11 KT 5.6628 M/S 18.579 F/S  
 POWER 550 HP 410.135 KW  
 THRUST 0 LB 0 KN  
 E= 83.5091 F= 0.289394 G= 24.167

JC3 - COAST GUARD BOAT

WLI 100A HULLS 293-316/CG SHIP			
LENGTH	100 FT	30.48 M	
WEIGHT	398720 LB	180859. KG	178 LT
SPEED	10.5 KT	5.4054 M/S	17.7345 F/S
POWER	600 HP	447.42 KW	
THRUST	0 LB	0 KN	
E=	21.4276	F= 0.312529	G= 6.69675
WLI 100B AZALEA 641/CG-375			
LENGTH	100 FT	30.48 M	
WEIGHT	448000 LB	203213. KG	200 LT
SPEED	9 KT	4.6332 M/S	15.201 F/S
POWER	440 HP	328.108 KW	
THRUST	0 LB	0 KN	
E=	28.1407	F= 0.267882	G= 7.5384
WLI 100C BUCKTHORN 642/CG SHIP			
LENGTH	100 FT	30.48 M	
WEIGHT	448000 LB	203213. KG	200 LT
SPEED	11.9 KT	6.12612 M/S	20.0991 F/S
POWER	600 HP	447.42 KW	
THRUST	0 LB	0 KN	
E=	27.2861	F= 0.3542	G= 9.66472
WLI 65303 BLACKBERRY/CG SHIP			
LENGTH	65 FT	19.812 M	
WEIGHT	152320 LB	69092.4 KG	68 LT
SPEED	9 KT	4.6332 M/S	15.201 F/S
POWER	220 HP	164.054 KW	
THRUST	0 LB	0 KN	
E=	19.1357	F= 0.332267	G= 6.35816
WLI 65400 BAYBERRY/CG SHIP			
LENGTH	65 FT	19.812 M	
WEIGHT	152320 LB	69092.4 KG	68 LT
SPEED	11.3 KT	5.81724 M/S	19.0857 F/S
POWER	400 HP	298.28 KW	
THRUST	0 LB	0 KN	
E=	13.2142	F= 0.41718	G= 5.51272
WLIC 75A ANVIL CONSTRN BARGE/CG SHIP			
LENGTH	75 FT	22.86 M	
WEIGHT	324800 LB	147329. KG	145 LT
SPEED	8.6 KT	4.42728 M/S	14.5254 F/S
POWER	600 HP	447.42 KW	
THRUST	0 LB	0 KN	
E=	14.2965	F= 0.295576	G= 4.22571
WLIC 75D AXE 75310/CG SHIP			
LENGTH	76 FT	23.1648 M	
WEIGHT	324800 LB	147329. KG	145 LT
SPEED	9.4 KT	4.83912 M/S	15.8766 F/S
POWER	600 HP	447.42 KW	
THRUST	0 LB	0 KN	
E=	15.6264	F= 0.320939	G= 5.01513

WLR 115 SUMAC RIV BUOY TENDER/CG SHIP  
 LENGTH 115 FT 35.052 M  
 WEIGHT 1070720 LB 485679. KG 478 LT  
 SPEED 10.6 KT 5.45688 M/S 17.9034 F/S  
 POWER 2250 HP 1677.82 KW  
 THRUST 0 LB 0 KN  
 E= 15.4905 F= 0.294211 G= 4.55748

WLR 114 DOGWOOD 259/CG SHIP  
 LENGTH 114 FT 34.7472 M  
 WEIGHT 694400 LB 314980. KG 310 LT  
 SPEED 11 KT 5.6628 M/S 18.579 F/S  
 POWER 800 HP 596.56 KW  
 THRUST 0 LB 0 KN  
 E= 29.321 F= 0.306649 G= 8.99128

WLR 65 OBION 65503/CG SHIP  
 LENGTH 66 FT 20.1168 M  
 WEIGHT 311360 LB 141233. KG 139 LT  
 SPEED 10.5 KT 5.4054 M/S 17.7345 F/S  
 POWER 600 HP 447.42 KW  
 THRUST 0 LB 0 KN  
 E= 16.7328 F= 0.384697 G= 6.43705

WLIC 160 HUDSON 801 INLAND CONSTRN TENDER/CG SHIP  
 LENGTH 160 FT 48.768 M  
 WEIGHT 931840 LB 422683. KG 416 LT  
 SPEED 10 KT 5.148 M/S 16.89 F/S  
 POWER 1000 HP 745.7 KW  
 THRUST 0 LB 0 KN  
 E= 28.616 F= 0.235311 G= 6.73364

WPB 95C LG PATROL CRAFT/CG SHIP  
 LENGTH 95 FT 28.956 M  
 WEIGHT 235200 LB 106687. KG 105 LT  
 SPEED 21 KT 10.8108 M/S 35.469 F/S  
 POWER 2324 HP 1733.01 KW  
 THRUST 0 LB 0 KN  
 E= 6.52661 F= 0.641297 G= 4.18549

WPB 82C LG PATROL CRAFT/CG SHIP  
 LENGTH 83 FT 25.2984 M  
 WEIGHT 147840 LB 67060.2 KG 66 LT  
 SPEED 23.7 KT 12.2008 M/S 40.0293 F/S  
 POWER 1600 HP 1193.12 KW  
 THRUST 0 LB 0 KN  
 E= 6.72492 F= 0.774303 G= 5.20713

WYTM 110A/B MED HARBOR TUG/CG SHIP  
 LENGTH 110 FT 33.528 M  
 WEIGHT 828800 LB 375944. KG 370 LT  
 SPEED 11.2 KT 5.76576 M/S 18.9168 F/S  
 POWER 1000 HP 745.7 KW  
 THRUST 0 LB 0 KN  
 E= 28.5059 F= 0.317851 G= 9.06062

WYTM 85 MESSENGER 85009/CG SHIP  
 LENGTH 85 FT 25.908 M  
 WEIGHT 515200 LB 233695. KG 230 LT  
 SPEED 9.5 KT 4.8906 M/S 16.0455 F/S  
 POWER 700 HP 521.99 KW  
 THRUST 0 LB 0 KN  
 E= 21.4718 F= 0.306701 G= 6.58543

WYTL 65A SMALL HARBOR TUG/CG SHIP  
 LENGTH 65 FT 19.812 M  
 WEIGHT 161280 LB 73156.6 KG 72 LT  
 SPEED 10.5 KT 5.4054 M/S 17.7345 F/S  
 POWER 400 HP 298.28 KW  
 THRUST 0 LB 0 KN  
 E= 13.001 F= 0.387645 G= 5.03977

MLB 44' MOTOR LIFEBOAT/CG-375		
LENGTH	44.1 FT	13.4417 M
WEIGHT	39491.2 LB	17913.2 KG
SPEED	16 KT	8.2368 M/S
POWER	340 HP	253.538 KW
THRUST	0 LB	0 KN
E=	5.70701	F= 0.717137
		G= 4.09271
MLB 52' CG-375		
LENGTH	52 FT	15.8496 M
WEIGHT	75779.2 LB	34373.4 KG
SPEED	11 KT	5.6628 M/S
POWER	340 HP	253.538 KW
THRUST	0 LB	0 KN
E=	7.52889	F= 0.454039
		G= 3.4184
MLB 36' CG-375		
LENGTH	36.83 FT	11.2258 M
WEIGHT	24617.6 LB	11166.5 KG
SPEED	9 KT	4.6332 M/S
POWER	100 HP	74.57 KW
THRUST	0 LB	0 KN
E=	6.80386	F= 0.441411
		G= 3.0033
MSB 25'8" MOTOR SURF BOAT/CG-375		
LENGTH	26.08 FT	7.94918 M
WEIGHT	6944 LB	3149.8 KG
SPEED	11 KT	5.6628 M/S
POWER	60 HP	44.742 KW
THRUST	0 LB	0 KN
E=	3.90947	F= 0.641122
		G= 2.50645
MCB MOTOR CARGO BOAT/CG-375		
LENGTH	24.42 FT	7.44322 M
WEIGHT	8108.8 LB	3678.15 KG
SPEED	8 KT	4.1184 M/S
POWER	30 HP	22.371 KW
THRUST	0 LB	0 KN
E=	6.64037	F= 0.481858
		G= 3.19971
MCBL LIGHT MCB/CG-375		
LENGTH	20.25 FT	6.1722 M
WEIGHT	6025.6 LB	2733.21 KG
SPEED	7.3 KT	3.75804 M/S
POWER	25 HP	18.6425 KW
THRUST	0 LB	0 KN
E=	5.40319	F= 0.48285
		G= 2.60893
BU MK II BUOY BOAT/CG-375		
LENGTH	45.3 FT	13.8074 M
WEIGHT	64960 LB	29465.9 KG
SPEED	9.2 KT	4.73616 M/S
POWER	180 HP	134.226 KW
THRUST	0 LB	0 KN
E=	10.196	F= 0.406856
		G= 4.14829



# JF1 - AIRCRAFT CARRIER

ARK ROYAL	BRITISH/JFS 73-74	
LENGTH	845 FT	257.556 M
WEIGHT	113760640 LB	5.16018 E+7 KG
SPEED	31.5 KT	16.2162 M/S
POWER	152000 HP	113346. KW
THRUST	0 LB	0 KN
E=	72.3979	F= 0.32254
		G= 23.3512
CVA 19	HANCOCK/JFS 73-74*	
LENGTH	894.5 FT	272.644 M
WEIGHT	100128000 LB	45418061 KG
SPEED	33 KT	16.9884 M/S
POWER	150000 HP	111855 KW
THRUST	0 LB	0 KN
E=	67.6465	F= 0.328417
		G= 22.2162
CVS 12	HORNET/ESSEX/JFS 73-74*	
LENGTH	890 FT	271.272 M
WEIGHT	89734400 LB	40703524 KG
SPEED	33 KT	16.9884 M/S
POWER	150000 HP	111855 KW
THRUST	0 LB	0 KN
E=	60.6246	F= 0.329246
		G= 19.9604
CVA 41	MIDWAY/JFS 73-74	
LENGTH	979 FT	298.399 M
WEIGHT	1.4336 E+8 LB	65028096 KG
SPEED	33 KT	16.9884 M/S
POWER	212000 HP	158088. KW
THRUST	0 LB	0 KN
E=	68.5288	F= 0.313924
		G= 21.5128
CVA 66	AMERICA/JFS 73-74	
LENGTH	1047.5 FT	319.278 M
WEIGHT	1.80992 E+8 LB	82097971 KG
SPEED	35 KT	18.018 M/S
POWER	280000 HP	208796 KW
THRUST	0 LB	0 KN
E=	69.4762	F= 0.321879
		G= 22.363
CVA 67	JFK/JFS 73-74	
LENGTH	1047.5 FT	319.278 M
WEIGHT	1.9488 E+8 LB	88397568 KG
SPEED	35 KT	18.018 M/S
POWER	280000 HP	208796 KW
THRUST	0 LB	0 KN
E=	74.8073	F= 0.321879
		G= 24.0789
CVAN 68	NIMITZ/JFS 73-74*	
LENGTH	1092 FT	332.842 M
WEIGHT	2.04736 E+8 LB	92868250 KG
SPEED	33 KT	16.9884 M/S
POWER	260000 HP	193882 KW
THRUST	0 LB	0 KN
E=	79.7998	F= 0.297238
		G= 23.7195

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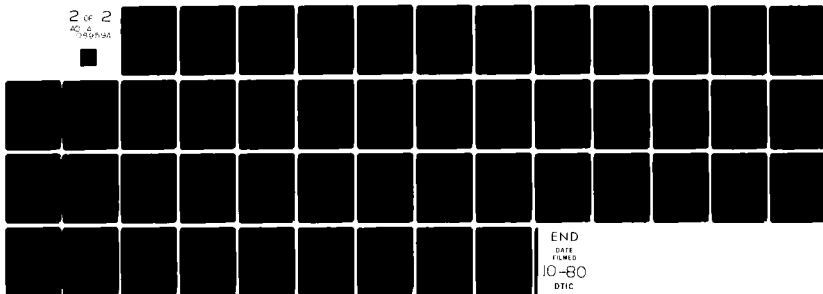
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CVA 59	FORRESTAL/JFS 73-74		
LENGTH	1039 FT	316.687 M	
WEIGHT	1.7472 E+8 LB	79252992 KG	78000 LT
SPEED	33 KT	16.9884 M/S	55.737 F/S
POWER	280000 HP	208796 KW	
THRUST	0 LB	0 KN	
E=	63.2362	F= 0.304725	G= 19.2696

CVAN 65	ENTERPRISE/JFS 73-74		
LENGTH	1123 FT	342.29 M	
WEIGHT	2.00704 E+8 LB	91039335 KG	89600 LT
SPEED	35 KT	18.018 M/S	59.115 F/S
POWER	280000 HP	208796 KW	
THRUST	0 LB	0 KN	
E=	77.043	F= 0.310871	G= 23.9504

FOR CARRIERS	33 KT	WAS USED WHERE JANES* GAVE 30+	
LENGTH	8 FT	2.4384 M	
WEIGHT	17920 LB	8128.51 KG	8 LT
SPEED	8 KT	4.1184 M/S	13.512 F/S
POWER	8 HP	5.9656 KW	
THRUST	8 LB	3.55872 E-2 KN	
E=	53.7112	F= 0.841873	G= 45.218

JF2 - BATTLESHIP

IOWA	BATTLESHIP		
LENGTH	887.2 FT	270.419 M	
WEIGHT	132160000 LB	59947776 KG	59000 LT
SPEED	35 KT	18.018 M/S	59.115 F/S
POWER	212000 HP	158088. KW	
THRUST	0 LB	0 KN	
E=	67.0038	F= 0.349751	G= 23.4346

# JF3 - CRUISER

CGN-9 LONG BEACH		JFS 73-74/ROWE	
LENGTH	720 FT	219.456 M	
WEIGHT	38821440 LB	1.76094 E+7 KG	17331 LT
SPEED	35 KT	18.018 M/S	59.115 F/S
POWER	80000 HP	59656 KW	
THRUST	0 LB	0 KN	
E=	52.1575	F= 0.388243	G= 20.2498

DLGN 35		TRUXTON/CGN35/JFS 73-74/ROWE*	
LENGTH	564 FT	171.907 M	
WEIGHT	20608000 LB	9.34779 E+6 KG	9200 LT
SPEED	31 KT	15.9588 M/S	52.359 F/S
POWER	80000 HP	59656 KW	
THRUST	0 LB	0 KN	
E=	24.5231	F= 0.388529	G= 9.52793

DLGN 25		BAINBRIDGE/CGN25/JFS 73-74	
LENGTH	565 FT	172.212 M	
WEIGHT	19241600 LB	8.72799 E+6 KG	8590 LT
SPEED	31 KT	15.9588 M/S	52.359 F/S
POWER	60000 HP	44742 KW	
THRUST	0 LB	0 KN	
E=	30.5294	F= 0.388185	G= 11.8511

DLG 26 BELKNAP		CG26/JFS 73-74/ROWE	
LENGTH	547 FT	166.726 M	
WEIGHT	17763200 LB	8.05739 E+6 KG	7930 LT
SPEED	34 KT	17.5032 M/S	57.426 F/S
POWER	85000 HP	63384.5 KW	
THRUST	0 LB	0 KN	
E=	21.8197	F= 0.4327	G= 9.44137

DLG 16 LEAHY		CG16/JFS 73-74/ROWE	
LENGTH	533 FT	162.458 M	
WEIGHT	17472000 LB	7.9253 E+6 KG	7800 LT
SPEED	34 KT	17.5032 M/S	57.426 F/S
POWER	85000 HP	63384.5 KW	
THRUST	0 LB	0 KN	
E=	21.462	F= 0.438346	G= 9.40777

CG 10 ALBANY		JFS 73-74	
LENGTH	673 FT	205.13 M	
WEIGHT	39200000 LB	17781120 KG	17500 LT
SPEED	33 KT	16.9884 M/S	55.737 F/S
POWER	120000 HP	89484 KW	
THRUST	0 LB	0 KN	
E=	33.1044	F= 0.378624	G= 12.5341

CLG 3 CLEVELAND	JFS 73-74	
LENGTH 610 FT	185.928 M	
WEIGHT 32704000 LB	1.48345 E+7 KG	14600 LT
SPEED 31.6 KT	16.2677 M/S	53.3724 F/S
POWER 100000 HP	74570 KW	
THRUST 0 LB	0 KN	
E= 31.7362	F= 0.380824	G= 12.0859

CA 134 DES MOINES	JFS 73-74	
LENGTH 716.5 FT	218.389 M	
WEIGHT 48160000 LB	21845376 KG	21500 LT
SPEED 33 KT	16.9884 M/S	55.737 F/S
POWER 120000 HP	89484 KW	
THRUST 0 LB	0 KN	
E= 40.6711	F= 0.366951	G= 14.9243

DLGN 36 CALIFORNIA	JFS 73-74*	
LENGTH 596 FT	181.661 M	
WEIGHT 22624000 LB	1.02622 E+7 KG	10100 LT
SPEED 31 KT	15.9588 M/S	52.359 F/S
POWER 70000 HP	52199 KW	
THRUST 0 LB	0 KN	
E= 30.7681	F= 0.377955	G= 11.6289

FOR CRUISERS 31 KT WAS USED WHERE JANES* GAVE 30+KT		
LENGTH 8 FT	2.4384 M	
WEIGHT 17920 LB	8128.51 KG	8 LT
SPEED 8 KT	4.1184 M/S	13.512 F/S
POWER 8 HP	5.9656 KW	
THRUST 8 LB	3.55872 E-2 KN	
E= 53.7112	F= 0.841873	G= 45.218

JF4 - DESTROYER/FRIGATE

DL-1 NORFOLK JFS 73-74

LENGTH	540 FT	164.592 M	
WEIGHT	16352000 LB	7.41727 E+6 KG	7300 LT
SPEED	32 KT	16.4736 M/S	54.048 F/S
POWER	80000 HP	59656 KW	
THRUST	0 LB	0 KN	
E=	20.0862	F= 0.409878	G= 8.2329

DL-2 MITSCHER (DDG 35)/JFS 73-74

LENGTH	493 FT	150.266 M	
WEIGHT	11648000 LB	5.28353 E+6 KG	5200 LT
SPEED	35 KT	18.018 M/S	59.115 F/S
POWER	80000 HP	59656 KW	
THRUST	0 LB	0 KN	
E=	15.6494	F= 0.469187	G= 7.34248

DD 931 FORREST SHERMAN/JFS 73-74/ROWE

LENGTH	418.4 FT	127.528 M	
WEIGHT	9083200 LB	4.12014 E+6 KG	4055 LT
SPEED	33 KT	16.9884 M/S	55.737 F/S
POWER	70000 HP	52199 KW	
THRUST	0 LB	0 KN	
E=	13.1499	F= 0.480197	G= 6.31454

DDG 31 DECATUR JFS 73-74

LENGTH	418.4 FT	127.528 M	
WEIGHT	9296000 LB	4.21667 E+6 KG	4150 LT
SPEED	33 KT	16.9884 M/S	55.737 F/S
POWER	70000 HP	52199 KW	
THRUST	0 LB	0 KN	
E=	13.458	F= 0.480197	G= 6.46247

DE 1040 GARCIA (FF 1040)JFS 73-74/ROWE

LENGTH	414.5 FT	126.34 M	
WEIGHT	7622720 LB	3.45767 E+6 KG	3403 LT
SPEED	27.5 KT	14.157 M/S	46.4475 F/S
POWER	35000 HP	26099.5 KW	
THRUST	0 LB	0 KN	
E=	18.3925	F= 0.402043	G= 7.39458

DD 692 SUMNER JFS 73-74

LENGTH	376.5 FT	114.757 M	
WEIGHT	7436800 LB	3.37333 E+6 KG	3320 LT
SPEED	34 KT	17.5032 M/S	57.426 F/S
POWER	60000 HP	44742 KW	
THRUST	0 LB	0 KN	
E=	12.9414	F= 0.521553	G= 6.74961

DE 1037 BRONSTEIN/(FF 1037)JFS 73-74/ROWE

LENGTH	371.5 FT	113.233 M	
WEIGHT	5936000 LB	2.69257 E+6 KG	2650 LT
SPEED	26 KT	13.3848 M/S	43.914 F/S
POWER	20000 HP	14914 KW	
THRUST	0 LB	0 KN	
E=	23.6976	F= 0.401509	G= 9.5148

DE 1006 DEALEY/COURTNEY/JFS 73-74/ROWE  
 LENGTH 314.5 FT 95.8596 M  
 WEIGHT 4211200 LB 1.9102 E+6 KG 1880 LT  
 SPEED 27 KT 13.8996 M/S 45.603 F/S  
 POWER 20000 HP 14914 KW  
 THRUST 0 LB 0 KN  
 E= 17.4585 F= 0.453164 G= 7.91155

DE 1033 CLAUDE JONES JFS 73-74/ROWE  
 LENGTH 310 FT 94.488 M  
 WEIGHT 3920000 LB 1778112 KG 1750 LT  
 SPEED 22 KT 11.3256 M/S 37.158 F/S  
 POWER 9200 HP 6860.44 KW  
 THRUST 0 LB 0 KN  
 E= 28.7864 F= 0.371915 G= 10.7061

DDG 2 CHARLES F. ADAMS/JFS 73-74/ROWE  
 LENGTH 437 FT 133.198 M  
 WEIGHT 10080000 LB 4572288 KG 4500 LT  
 SPEED 35 KT 18.018 M/S 59.115 F/S  
 POWER 70000 HP 52199 KW  
 THRUST 0 LB 0 KN  
 E= 15.4774 F= 0.498344 G= 7.71306

FFG PATROL FRIGATE JFS 73-74  
 LENGTH 450 FT 137.16 M  
 WEIGHT 8225280 LB 3730987 KG 3672 LT  
 SPEED 28.5 KT 14.6718 M/S 48.1365 F/S  
 POWER 41000 HP 30573.7 KW  
 THRUST 0 LB 0 KN  
 E= 17.5581 F= 0.39989 G= 7.02132

DD 963 SPRUANCE JFS 73-74  
 LENGTH 560 FT 170.688 M  
 WEIGHT 15456000 LB 7.01084 E+6 KG 6900 LT  
 SPEED 32 KT 16.4736 M/S 54.048 F/S  
 POWER 80000 HP 59656 KW  
 THRUST 0 LB 0 KN  
 E= 18.9856 F= 0.402492 G= 7.64155

DD 710 GEARING/JFS 73-74  
 LENGTH 390.5 FT 119.024 M  
 WEIGHT 7840000 LB 3556224 KG 3500 LT  
 SPEED 34 KT 17.5032 M/S 57.426 F/S  
 POWER 60000 HP 44742 KW  
 THRUST 0 LB 0 KN  
 E= 13.643 F= 0.512119 G= 6.98684

DE 1052 KNOX JFS 73-74  
 LENGTH 438 FT 133.502 M  
 WEIGHT 9184000 LB 4.16586 E+6 KG 4100 LT  
 SPEED 27 KT 13.8996 M/S 45.603 F/S  
 POWER 35000 HP 26099.5 KW  
 THRUST 0 LB 0 KN  
 E= 21.7568 F= 0.383998 G= 8.35455

DLG 6 COONTZ JFS 73-74  
 LENGTH 512.5 FT 156.21 M  
 WEIGHT 12992000 LB 5.89317 E+6 KG 5800 LT  
 SPEED 34 KT 17.5032 M/S 57.426 F/S  
 POWER 85000 HP 63384.5 KW  
 THRUST 0 LB 0 KN  
 E= 15.9589 F= 0.447027 G= 7.13406

DL 5 WILKINSON JFS 73-74  
 LENGTH 493 FT 150.266 M  
 WEIGHT 10595200 LB 4.80598 E+6 KG 4730 LT  
 SPEED 35 KT 18.018 M/S 59.115 F/S  
 POWER 80000 HP 59656 KW  
 THRUST 0 LB 0 KN  
 E= 14.2349 F= 0.469187 G= 6.67883

JF5 - SWATH

SSP KAIMALINO LANG		
LENGTH 89 FT	27.1272 M	
WEIGHT 425600 LB	193052. KG	190 LT
SPEED 25 KT	12.87 M/S	42.225 F/S
POWER 4200 HP	3131.94 KW	
THRUST 0 LB	0 KN	
E= 7.77964	F= 0.788763	G= 6.13629



JF6 - BIRRID CONCEPT

HYSWAS *		CONCEPT/MEYER	
LENGTH	257 FT	78.3336 M	
WEIGHT	4480000 LB	2032128 KG	2000 LT
SPEED	42 KT	21.6216 M/S	70.938 F/S
POWER	60000 HP	44742 KW	
THRUST	0 LB	0 KN	
E=	9.63037	F= 0.779802	G= 7.50978

LAHHS *		CONCEPT/MEYER	
LENGTH	310 FT	94.488 M	
WEIGHT	4480000 LB	2032128 KG	2000 LT
SPEED	44 KT	22.6512 M/S	74.316 F/S
POWER	60000 HP	44742 KW	
THRUST	0 LB	0 KN	
E=	10.089	F= 0.74383	G= 7.50447

HYACS *		L/B=4 CONCEPT/MEYER	
LENGTH	254 FT	77.4192 M	
WEIGHT	4480000 LB	2032128 KG	2000 LT
SPEED	43.5 KT	22.3938 M/S	73.4715 F/S
POWER	60000 HP	44742 KW	
THRUST	0 LB	0 KN	
E=	9.97431	F= 0.812408	G= 8.10321

SWAACS *		L/B=4 CONCEPT/MEYER	
LENGTH	254 FT	77.4192 M	
WEIGHT	4480000 LB	2032128 KG	2000 LT
SPEED	39.5 KT	20.3346 M/S	66.7155 F/S
POWER	60000 HP	44742 KW	
THRUST	0 LB	0 KN	
E=	9.05713	F= 0.737704	G= 6.68148

# JH1 - FULLY-SUBMERGED HYDROFOIL

LITTLE SQUIRT BOEING 1ST WATERJET/SLBRY			
LENGTH	20 FT	6.096 M	
WEIGHT	5824 LB	2641.77 KG	2.6 LT
SPEED	46 KT	23.6808 M/S	77.694 F/S
POWER	450 HP	335.565 KW	
THRUST	0 LB	0 KN	
E=	1.82824	F= 3.06157	G= 5.59729
HIGH POINT NAVY PCH-1 MOD 0/JSKMR 71-72/MNTL			
LENGTH	115.7 FT	35.2654 M	
WEIGHT	250880 LB	113799. KG	112 LT
SPEED	48 KT	24.7104 M/S	81.072 F/S
POWER	6200 HP	4623.34 KW	
THRUST	0 LB	0 KN	
E=	5.96462	F= 1.32824	G= 7.92244
HIGH POINT MOD-1/MNTL			
LENGTH	115.7 FT	35.2654 M	
WEIGHT	282240 LB	128024. KG	126 LT
SPEED	50 KT	25.74 M/S	84.45 F/S
POWER	7800 HP	5816.46 KW	
THRUST	0 LB	0 KN	
E=	5.55598	F= 1.38358	G= 7.68716
PLAINVIEW NAVY AGEH-1/JSKMR/MNTL			
LENGTH	212 FT	64.6176 M	
WEIGHT	716800 LB	325140. KG	320 LT
SPEED	50 KT	25.74 M/S	84.45 F/S
POWER	28000 HP	20879.6 KW	
THRUST	0 LB	0 KN	
E=	3.93076	F= 1.02212	G= 4.01773
PEGASUS NAVY PHM-1/MNTL			
LENGTH	129 FT	39.3192 M	
WEIGHT	517440 LB	234711. KG	231 LT
SPEED	50 KT	25.74 M/S	84.45 F/S
POWER	16600 HP	12378.6 KW	
THRUST	0 LB	0 KN	
E=	4.78618	F= 1.31032	G= 6.27142
FLAGSTAFF NAVY PGH-1/MNTL			
LENGTH	74 FT	22.5552 M	
WEIGHT	151200 LB	68584.3 KG	67.5 LT
SPEED	53 KT	27.2844 M/S	89.517 F/S
POWER	3450 HP	2572.67 KW	
THRUST	0 LB	0 KN	
E=	7.13305	F= 1.83384	G= 13.0809
TUCUMCARI NAVY PGH-2/MNTL			
LENGTH	72 FT	21.9456 M	
WEIGHT	130368 LB	59134.9 KG	58.2 LT
SPEED	53 KT	27.2844 M/S	89.517 F/S
POWER	3200 HP	2386.24 KW	
THRUST	0 LB	0 KN	
E=	6.63077	F= 1.85914	G= 12.3275

FRESH-1	NAVY-BOEING/MNTL	
LENGTH 57 FT	17.3736 M	
WEIGHT 37408 LB	16968.3 KG	16.7 LT
SPEED 83 KT	42.7284 M/S	140.187 F/S
POWER 0 HP	0 KW	
THRUST 18000 LB	80.0712 KN	
E= 2.07822	F= 3.27222	G= 6.8004

JET FOIL	BOEING COMML/SLTZ/CRUISE V	
LENGTH 90 FT	27.432 M	
WEIGHT 237440 LB	107703. KG	106 LT
SPEED 45 KT	23.166 M/S	76.005 F/S
POWER 6600 HP	4921.62 KW	
THRUST 0 LB	0 KN	
E= 4.97152	F= 1.41186	G= 7.01912

TAIFUN	USSR TYPHOON/JSKMR	
LENGTH 103 FT	31.3944 M	
WEIGHT 145600 LB	66044.2 KG	65 LT
SPEED 42.5 KT	21.879 M/S	71.7825 F/S
POWER 3500 HP	2609.95 KW	
THRUST 0 LB	0 KN	
E= 5.42937	F= 1.24644	G= 6.76739

DOLPHIN	GRUMMAN/HCHF66	
LENGTH 75 FT	22.86 M	
WEIGHT 132272 LB	59998.6 KG	59.05 LT
SPEED 51.9 KT	26.7181 M/S	87.6591 F/S
POWER 3500 HP	2609.95 KW	
THRUST 0 LB	0 KN	
E= 6.0233	F= 1.78377	G= 10.7442

SEA LEGS	NAVY/MIT	
LENGTH 29 FT	8.8392 M	
WEIGHT 8984.64 LB	4075.43 KG	4.011 LT
SPEED 31 KT	15.9588 M/S	52.359 F/S
POWER 220 HP	164.054 KW	
THRUST 0 LB	0 KN	
E= 3.88782	F= 1.71342	G= 6.66148

ALBATROSS	WILSON/HCHF/63	
LENGTH 33.8 FT	10.3022 M	
WEIGHT 13440 LB	6096.38 KG	6 LT
SPEED 35 KT	18.018 M/S	59.115 F/S
POWER 181 HP	134.972 KW	
THRUST 0 LB	0 KN	
E= 7.98097	F= 1.79189	G= 14.301

TURYA	USSR HYBRID	
LENGTH 131 FT	39.9288 M	
WEIGHT 448000 LB	203213. KG	200 LT
SPEED 45 KT	23.166 M/S	76.005 F/S
POWER 12900 HP	9619.53 KW	
THRUST 0 LB	0 KN	
E= 4.79919	F= 1.17025	G= 5.61625

# JH2 - SURFACE-EFFECT HYDROFOIL

## RAKETA SOVIET 58/JSKMRN 72-73/MNTL

LENGTH	88.6 FT	27.0053 M	
WEIGHT	56672 LB	25706.4 KG	25.3 LT
SPEED	40 KT	20.592 M/S	67.56 F/S
POWER	1200 HP	894.84 KW	
THRUST	0 LB	0 KN	
E=	5.80115	F= 1.26487	G= 7.33769

## CHAIKA USSR/JSKMR

LENGTH	86.3 FT	26.3042 M	
WEIGHT	32032 LB	14529.7 KG	14.3 LT
SPEED	46.5 KT	23.9382 M/S	78.5385 F/S
POWER	1200 HP	894.84 KW	
THRUST	0 LB	0 KN	
E=	3.81174	F= 1.48987	G= 5.679

## METEOR USSR 60/MVCH

LENGTH	112 FT	34.1376 M	
WEIGHT	116480 LB	52835.3 KG	52 LT
SPEED	49.7 KT	25.5856 M/S	83.9433 F/S
POWER	1800 HP	1342.26 KW	
THRUST	0 LB	0 KN	
E=	9.87648	F= 1.39781	G= 13.8055

## SPUTNIK USSR 61/JSKMR/HYWRD

LENGTH	157 FT	47.8536 M	
WEIGHT	246400 LB	111767. KG	110 LT
SPEED	49.7 KT	25.5856 M/S	83.9433 F/S
POWER	3600 HP	2684.52 KW	
THRUST	0 LB	0 KN	
E=	10.4463	F= 1.18061	G= 12.333

## STRELA USSR 61/JSKMR/HYWRD

LENGTH	96.1 FT	29.2913 M	
WEIGHT	103040 LB	46738.9 KG	46 LT
SPEED	40 KT	20.592 M/S	67.56 F/S
POWER	1940 HP	1446.66 KW	
THRUST	0 LB	0 KN	
E=	6.52426	F= 1.21451	G= 7.92376

## KOMETA USSR 61/JSKMR

LENGTH	115.5 FT	35.2044 M	
WEIGHT	125440 LB	56899.6 KG	56 LT
SPEED	34 KT	17.5032 M/S	57.426 F/S
POWER	1800 HP	1342.26 KW	
THRUST	0 LB	0 KN	
E=	7.27628	F= 0.94165	G= 6.85171

## MOLNIA USSR 61/JSKMR/MVCH

LENGTH	27.75 FT	8.4582 M	
WEIGHT	3920 LB	1778.11 KG	1.75 LT
SPEED	40.4 KT	20.7979 M/S	68.2356 F/S
POWER	90 HP	67.113 KW	
THRUST	0 LB	0 KN	
E=	5.40371	F= 2.28271	G= 12.3351

VIKHR	USSR 62/JSKMR		
LENGTH	156 FT	47.5488 M	
WEIGHT	263200 LB	119388. KG	117.5 LT
SPEED	43 KT	22.1364 M/S	72.627 F/S
POWER	4800 HP	3579.36 KW	
THRUST	0 LB	0 KN	
E=	7.24069	F= 1.02473	G= 7.41973

BUREVESTNIK	USSR 68/JSKMR		
LENGTH	142 FT	43.2816 M	
WEIGHT	150080 LB	68076.3 KG	67 LT
SPEED	50 KT	25.74 M/S	84.45 F/S
POWER	5400 HP	4026.78 KW	
THRUST	0 LB	0 KN	
E=	4.26743	F= 1.2489	G= 5.32959

VOLGA	USSR SPORT/BROCHURE		
LENGTH	27.8 FT	8.47344 M	
WEIGHT	4159.68 LB	1886.83 KG	1.857 LT
SPEED	37.3 KT	19.202 M/S	62.9997 F/S
POWER	77 HP	57.4189 KW	
THRUST	0 LB	0 KN	
E=	6.18792	F= 2.10566	G= 13.0297

VOSKHOD	USSR/JSKMR		
LENGTH	76 FT	23.1648 M	
WEIGHT	49280 LB	22353.4 KG	22 LT
SPEED	35 KT	18.018 M/S	59.115 F/S
POWER	900 HP	671.13 KW	
THRUST	0 LB	0 KN	
E=	5.88523	F= 1.19499	G= 7.03277

# JH3 - SURFACE-PIERCING HYDROFOIL

BELL-BALDWIN HD-4		NUTTING/MNTL/HYWRD	
LENGTH	60 FT	18.288 M	
WEIGHT	10998.4 LB	4988.87 KG	4.91 LT
SPEED	61.5 KT	31.6602 M/S	103.873 F/S
POWER	700 HP	521.99 KW	
THRUST	0 LB	0 KN	
E=	2.96738	F= 2.3632	G= 7.01253
TIETJENS 1932/HYWRD/HRNR			
LENGTH	20 FT	6.096 M	
WEIGHT	528.64 LB	239.791 KG	0.236 LT
SPEED	21.6 KT	11.1197 M/S	36.4824 F/S
POWER	5 HP	3.7285 KW	
THRUST	0 LB	0 KN	
E=	7.01311	F= 1.43761	G= 10.0821
KOBO 1939/EXP KONS BOAT/HRNR/HCHF 63			
LENGTH	32 FT	9.7536 M	
WEIGHT	6272 LB	2844.98 KG	2.8 LT
SPEED	39 KT	20.0772 M/S	65.871 F/S
POWER	160 HP	119.312 KW	
THRUST	0 LB	0 KN	
E=	4.69481	F= 2.05207	G= 9.63405
TS 1-5 GERMAN SACHSENBERG 42/HOLL/HCHF			
LENGTH	38.1 FT	11.6129 M	
WEIGHT	14112 LB	6401.2 KG	6.3 LT
SPEED	40 KT	20.592 M/S	67.56 F/S
POWER	400 HP	298.28 KW	
THRUST	0 LB	0 KN	
E=	4.33367	F= 1.92885	G= 8.35901
TS 6 1943 GERMAN/HOLL			
LENGTH	39.3 FT	11.9786 M	
WEIGHT	14112 LB	6401.2 KG	6.3 LT
SPEED	40 KT	20.592 M/S	67.56 F/S
POWER	380 HP	283.366 KW	
THRUST	0 LB	0 KN	
E=	4.56175	F= 1.89918	G= 8.66358
BRITISH WHITE&CO 1937/HYWRD			
LENGTH	67.33 FT	20.5222 M	
WEIGHT	62720 LB	28449.8 KG	28 LT
SPEED	41.35 KT	21.287 M/S	69.8401 F/S
POWER	3000 HP	2237.1 KW	
THRUST	0 LB	0 KN	
E=	2.65477	F= 1.49994	G= 3.98199
VS 6 1942 GERMAN NAVY/HOLL/SCHR/HYWRD/HCHF			
LENGTH	52.5 FT	16.002 M	
WEIGHT	38080 LB	17273.1 KG	17 LT
SPEED	47.5 KT	24.453 M/S	80.2275 F/S
POWER	1560 HP	1163.29 KW	
THRUST	0 LB	0 KN	
E=	3.56068	F= 1.95126	G= 6.94782

VS 7 1943 GERMAN/HRNR/HOLL  
 LENGTH 46 FT 14.0208 M  
 WEIGHT 33600 LB 15241. KG 15 LT  
 SPEED 54 KT 27.7992 M/S 91.206 F/S  
 POWER 1300 HP 969.41 KW  
 THRUST 0 LB 0 KN  
 E= 4.28604 F= 2.36983 G= 10.1572

VS 3 1943 GERMAN/HRNR/HYWRD/HOLL/HCHF  
 LENGTH 105 FT 32.004 M  
 WEIGHT 179200 LB 81285.1 KG 80 LT  
 SPEED 43 KT 22.1364 M/S 72.627 F/S  
 POWER 3660 HP 2729.26 KW  
 THRUST 0 LB 0 KN  
 E= 6.46535 F= 1.24904 G= 8.07547

HIGH POCKETS ONR 1952/HYWRD/HOLL/HRNR  
 LENGTH 23 FT 7.0104 M  
 WEIGHT 6003.2 LB 2723.05 KG 2.68 LT  
 SPEED 35 KT 18.018 M/S 59.115 F/S  
 POWER 125 HP 93.2125 KW  
 THRUST 0 LB 0 KN  
 E= 5.16188 F= 2.17223 G= 11.2128

MASSAWIPI R-100 CANADIAN 1952/HOLL/HRNR  
 LENGTH 45 FT 13.716 M  
 WEIGHT 12544 LB 5689.96 KG 5.6 LT  
 SPEED 60 KT 30.888 M/S 101.34 F/S  
 POWER 1260 HP 939.582 KW  
 THRUST 0 LB 0 KN  
 E= 1.83436 F= 2.66224 G= 4.88349

FRECCIA D'ORO 1953/HRNR/HOLL/CREWE  
 LENGTH 46.6 FT 14.2037 M  
 WEIGHT 22848 LB 10363.9 KG 10.2 LT  
 SPEED 45.8 KT 23.5778 M/S 77.3562 F/S  
 POWER 550 HP 410.135 KW  
 THRUST 0 LB 0 KN  
 E= 5.84276 F= 1.99698 G= 11.6679

PT-10 SUPRAMAR 53/HOLL/CREWE  
 LENGTH 51 FT 15.5448 M  
 WEIGHT 25088 LB 11379.9 KG 11.2 LT  
 SPEED 42 KT 21.6216 M/S 70.938 F/S  
 POWER 600 HP 447.42 KW  
 THRUST 0 LB 0 KN  
 E= 5.39301 F= 1.75052 G= 9.44054

XCH-4 CARL/ONR 54/HYWRD/HOLL/HRNR  
 LENGTH 53 FT 16.1544 M  
 WEIGHT 16508.8 LB 7488.39 KG 7.37 LT  
 SPEED 79 KT 40.6692 M/S 133.431 F/S  
 POWER 950 HP 708.415 KW  
 THRUST 0 LB 0 KN  
 E= 4.21586 F= 3.22991 G= 13.6169

PT-20 SUPRAMAR 56/HRNR/HOLL/CREWE  
 LENGTH 68 FT 20.7264 M  
 WEIGHT 62720 LB 28449.8 KG 28 LT  
 SPEED 43 KT 22.1364 M/S 72.627 F/S  
 POWER 1350 HP 1006.69 KW  
 THRUST 0 LB 0 KN  
 E= 6.1349 F= 1.55209 G= 9.5219

PT-50 SUPRAMAR 58/HRNR/HOLL  
 LENGTH 88.6 FT 27.0053 M  
 WEIGHT 134400 LB 60963.8 KG 60 LT  
 SPEED 40 KT 20.592 M/S 67.56 F/S  
 POWER 2700 HP 2013.39 KW  
 THRUST 0 LB 0 KN  
 E= 6.11452 F= 1.26487 G= 7.73406

BADDECK CANADA R-103/EX BRAS DOR/CREWE/HOLL  
 LENGTH 59 FT 17.9832 M  
 WEIGHT 39200 LB 17781.1 KG 17.5 LT  
 SPEED 55 KT 28.314 M/S 92.895 F/S  
 POWER 3000 HP 2237.1 KW  
 THRUST 0 LB 0 KN  
 E= 2.20696 F= 2.13127 G= 4.70363

PTS-75MK III SUPRAMAR/MNTL  
 LENGTH 98.5 FT 30.0228 M  
 WEIGHT 179200 LB 81285.1 KG 80 LT  
 SPEED 39 KT 20.0772 M/S 65.871 F/S  
 POWER 3300 HP 2460.81 KW  
 THRUST 0 LB 0 KN  
 E= 6.50363 F= 1.16963 G= 7.60683

PTS-150 MK III SUPRAMAR/MNTL  
 LENGTH 124.2 FT 37.8562 M  
 WEIGHT 369600 LB 167651. KG 165 LT  
 SPEED 36.5 KT 18.7902 M/S 61.6485 F/S  
 POWER 6800 HP 5070.76 KW  
 THRUST 0 LB 0 KN  
 E= 6.09232 F= 0.974841 G= 5.93905

BRAS D'OR FHE 400/CANADA/JSKMR/MNTL  
 LENGTH 151 FT 46.0248 M  
 WEIGHT 474880 LB 215406. KG 212 LT  
 SPEED 63 KT 32.4324 M/S 106.407 F/S  
 POWER 22000 HP 16405.4 KW  
 THRUST 0 LB 0 KN  
 E= 4.17608 F= 1.526 G= 6.37269

RHS-70 RODRIQUEZ/JSKMR/MNTL  
 LENGTH 72.2 FT 22.0066 M  
 WEIGHT 70560 LB 32006. KG 31.5 LT  
 SPEED 36.5 KT 18.7902 M/S 61.6485 F/S  
 POWER 1350 HP 1006.69 KW  
 THRUST 0 LB 0 KN  
 E= 5.85848 F= 1.27857 G= 7.4905

RHS 110 RODRIQUEZ/JSKMR/MNTL  
 LENGTH 83.2 FT 25.3594 M  
 WEIGHT 116480 LB 52835.3 KG 52 LT  
 SPEED 40 KT 20.592 M/S 67.56 F/S  
 POWER 2700 HP 2013.39 KW  
 THRUST 0 LB 0 KN  
 E= 5.29925 F= 1.30527 G= 6.91695

RHS 140 RODRIQUEZ/JSKMR/MNTL  
 LENGTH 94.1 FT 28.6817 M  
 WEIGHT 145600 LB 66044.2 KG 65 LT  
 SPEED 36 KT 18.5328 M/S 60.804 F/S  
 POWER 2700 HP 2013.39 KW  
 THRUST 0 LB 0 KN  
 E= 5.96166 F= 1.10461 G= 6.58531



RHS 160	RODRIGUEZ/JSKMR/MNTL	
LENGTH 101.5 FT	30.9372 M	
WEIGHT 183680 LB	83317.2 KG	82 LT
SPEED 39 KT	20.0772 M/S	65.871 F/S
POWER 3840 HP	2863.49 KW	
THRUST 0 LB	0 KN	
E= 5.72878	F= 1.15221	G= 6.60078

MIAMI SHIPBUILDING CORP	ONR/HRNR/HOLL	
LENGTH 16 FT	4.8768 M	
WEIGHT 3136 LB	1422.49 KG	1.4 LT
SPEED 27 KT	13.8996 M/S	45.603 F/S
POWER 50 HP	37.285 KW	
THRUST 0 LB	0 KN	
E= 5.2004	F= 2.00912	G= 10.4482

HOOK KIT	DEE ALPHA DEE TEE/HRNR/HOLL	
LENGTH 22 FT	6.7056 M	
WEIGHT 5600 LB	2540.16 KG	2.5 LT
SPEED 32 KT	16.4736 M/S	54.048 F/S
POWER 100 HP	74.57 KW	
THRUST 0 LB	0 KN	
E= 5.50307	F= 2.03067	G= 11.1749

AQUASTROLL	AQUAVION 24/40/57/HOLL	
LENGTH 47.1 FT	14.3561 M	
WEIGHT 37408 LB	16968.3 KG	16.7 LT
SPEED 32 KT	16.4736 M/S	54.048 F/S
POWER 500 HP	372.85 KW	
THRUST 0 LB	0 KN	
E= 7.3521	F= 1.38785	G= 10.2036

XCH-6	SEA WINGS/ONR 58/HOLL/UNPUBL DATA	
LENGTH 23.3 FT	7.10184 M	
WEIGHT 2549.12 LB	1156.28 KG	1.138 LT
SPEED 63 KT	32.4324 M/S	106.407 F/S
POWER 200 HP	149.14 KW	
THRUST 0 LB	0 KN	
E= 2.46586	F= 3.88476	G= 9.57926

# JL1 - PLANING

TENACITY	JANE'S 71-72		
LENGTH	144.5 FT	44.0436 M	
WEIGHT	492800 LB	223534. KG	220 LT
SPEED	40 KT	20.592 M/S	67.56 F/S
POWER	12750 HP	9507.68 KW	
THRUST	0 LB	0 KN	
E=	4.74775	F= 0.990439	G= 4.70235
PG-84	ASHEVILLE/JFS 73-74		
LENGTH	164.5 FT	50.1396 M	
WEIGHT	548800 LB	248936. KG	245 LT
SPEED	37.5 KT	19.305 M/S	63.3375 F/S
POWER	13300 HP	9917.81 KW	
THRUST	0 LB	0 KN	
E=	4.75183	F= 0.870262	G= 4.13534
HMS BRAVE BORDERER	JFS 73-74/HCHF 74		
LENGTH	98.8 FT	30.1142 M	
WEIGHT	255360 LB	115831. KG	114 LT
SPEED	52 KT	26.7696 M/S	87.828 F/S
POWER	10500 HP	7829.85 KW	
THRUST	0 LB	0 KN	
E=	3.88359	F= 1.55714	G= 6.04729
PTF-3 NASTY	JFS 73-74		
LENGTH	80.3 FT	24.4754 M	
WEIGHT	190400 LB	86365.4 KG	85 LT
SPEED	45 KT	23.166 M/S	76.005 F/S
POWER	6200 HP	4623.34 KW	
THRUST	0 LB	0 KN	
E=	4.2438	F= 1.49471	G= 6.34324
PCF SWIFT	JFS 73-74		
LENGTH	50.1 FT	15.2705 M	
WEIGHT	50400 LB	22861.4 KG	22.5 LT
SPEED	28 KT	14.4144 M/S	47.292 F/S
POWER	960 HP	715.872 KW	
THRUST	0 LB	0 KN	
E=	4.51424	F= 1.17745	G= 5.31527
CPIC	COASTAL PATROL INTERD CR/JFS 73-74		
LENGTH	99.2 FT	30.2362 M	
WEIGHT	159600 LB	72394.6 KG	71.25 LT
SPEED	43 KT	22.1364 M/S	72.627 F/S
POWER	5400 HP	4026.78 KW	
THRUST	0 LB	0 KN	
E=	3.90278	F= 1.28503	G= 5.01521
PTF 23	JFS 73-74		
LENGTH	94.7 FT	28.8646 M	
WEIGHT	235200 LB	106687. KG	105 LT
SPEED	40 KT	20.592 M/S	67.56 F/S
POWER	6200 HP	4623.34 KW	
THRUST	0 LB	0 KN	
E=	4.65986	F= 1.22345	G= 5.70111

BOEING HTS		HYDRODYNAMIC TEST SYSTEM/CHAP	
LENGTH	38 FT	11.5824 M	
WEIGHT	15008 LB	6807.63 KG	6.7 LT
SPEED	110 KT	56.628 M/S	185.79 F/S
POWER	0 HP	0 KW	
THRUST	6350 LB	28.2473 KN	
E=	2.36346	F= 5.31132	G= 12.5531

UTB MK VI		LG UTIL BOAT/CG-375	
LENGTH	40.67 FT	12.3962 M	
WEIGHT	24304 LB	11024.3 KG	10.85 LT
SPEED	25.8 KT	13.2818 M/S	43.5762 F/S
POWER	560 HP	417.592 KW	
THRUST	0 LB	0 KN	
E=	3.43856	F= 1.20416	G= 4.14058

UTM MK III		MED UTIL BOAT/CG-375	
LENGTH	31.06 FT	9.46709 M	
WEIGHT	15975.7 LB	7246.57 KG	7.132 LT
SPEED	26 KT	13.3848 M/S	43.914 F/S
POWER	240 HP	178.968 KW	
THRUST	0 LB	0 KN	
E=	5.31482	F= 1.38859	G= 7.38011

UTL 16'		MOTOR LAUNCH/CG-375	
LENGTH	16.38 FT	4.99262 M	
WEIGHT	2300.48 LB	1043.5 KG	1.027 LT
SPEED	21 KT	10.8108 M/S	35.469 F/S
POWER	40 HP	29.828 KW	
THRUST	0 LB	0 KN	
E=	3.7089	F= 1.54442	G= 5.72808

TICWAN		AIDS-TO-NAV BOAT/CG-375	
LENGTH	19.54 FT	5.95579 M	
WEIGHT	5801.6 LB	2631.61 KG	2.59 LT
SPEED	21 KT	10.8108 M/S	35.469 F/S
POWER	120 HP	89.484 KW	
THRUST	0 LB	0 KN	
E=	3.11783	F= 1.41403	G= 4.40871

SKB		LG SKIFF/BOSTON WHALER/CG-375	
LENGTH	16.58 FT	5.05358 M	
WEIGHT	2912 LB	1320.88 KG	1.3 LT
SPEED	23 KT	11.8404 M/S	38.847 F/S
POWER	50 HP	37.285 KW	
THRUST	0 LB	0 KN	
E=	4.11354	F= 1.68127	G= 6.91598

# JL2 - AIR CUSHION VEHICLE

GORKOVCHANIN USSR/JSKMR 72-73		
LENGTH	72.17 FT	21.9974 M
WEIGHT	32032 LB	14529.7 KG
		14.3 LT
SPEED	19.8 KT	10.193 M/S
		33.4422 F/S
POWER	265 HP	197.611 KW
THRUST	0 LB	0 KN
E=	7.34971	F= 0.693727
		G= 5.09869

SKATE USSR/JSKMR		
LENGTH	67.6 FT	20.6045 M
WEIGHT	60480 LB	27433.7 KG
		27 LT
SPEED	50 KT	25.74 M/S
		84.45 F/S
POWER	2340 HP	1744.94 KW
THRUST	0 LB	0 KN
E=	3.96856	F= 1.81008
		G= 7.18342

RADUGA USSR/JSKMR		
LENGTH	30.83 FT	9.39698 M
WEIGHT	6720 LB	3048.19 KG
		3 LT
SPEED	65.1 KT	33.5135 M/S
		109.954 F/S
POWER	440 HP	328.108 KW
THRUST	0 LB	0 KN
E=	3.05327	F= 3.48976
		G= 10.6552

SORMOVICH USSR/JSKMR		
LENGTH	96 FT	29.2608 M
WEIGHT	67200 LB	30481.9 KG
		30 LT
SPEED	75 KT	38.61 M/S
		126.675 F/S
POWER	2500 HP	1864.25 KW
THRUST	0 LB	0 KN
E=	6.19095	F= 2.27839
		G= 14.1054

ZARYA USSR/JSKMR		
LENGTH	66.9 FT	20.3911 M
WEIGHT	49280 LB	22353.4 KG
		22 LT
SPEED	22.6 KT	11.6345 M/S
		38.1714 F/S
POWER	1100 HP	820.27 KW
THRUST	0 LB	0 KN
E=	3.10923	F= 0.822426
		G= 2.55712

NEVA USSR/JSKMR		
LENGTH	57 FT	17.3736 M
WEIGHT	26880 LB	12192.8 KG
		12 LT
SPEED	30 KT	15.444 M/S
		50.67 F/S
POWER	715 HP	533.175 KW
THRUST	0 LB	0 KN
E=	3.46347	F= 1.18273
		G= 4.09635

ZARNITSA USSR/JSKMR/MNTL		
LENGTH	72.25 FT	22.0218 M
WEIGHT	33084.8 LB	15007.3 KG
		14.77 LT
SPEED	19.1 KT	9.83268 M/S
		32.2599 F/S
POWER	265 HP	197.611 KW
THRUST	0 LB	0 KN
E=	7.3229	F= 0.668831
		G= 4.89778

ORION		USSR/JSKMR	
LENGTH	82 FT	24.9936 M	
WEIGHT	72755.2 LB	33001.8 KG	32.48 LT
SPEED	28.6 KT	14.7233 M/S	48.3054 F/S
POWER	1026 HP	765.088 KW	
THRUST	0 LB	0 KN	
E=	6.22802	F= 0.940071	G= 5.85478
VOYAGEUR		CANADA/MNTL/JSKMR	
LENGTH	65.7 FT	20.0254 M	
WEIGHT	91000 LB	41277.6 KG	40.625 LT
SPEED	47 KT	24.1956 M/S	79.383 F/S
POWER	2600 HP	1938.82 KW	
THRUST	0 LB	0 KN	
E=	5.05165	F= 1.7259	G= 8.71866
VIKING		CANADA/MNTL/JSKMR	
LENGTH	44.5 FT	13.5636 M	
WEIGHT	32502.4 LB	14743.1 KG	14.51 LT
SPEED	49.6 KT	25.5341 M/S	83.7744 F/S
POWER	1300 HP	969.41 KW	
THRUST	0 LB	0 KN	
E=	3.80821	F= 2.21311	G= 8.42799
N 102		FRANCE SEDAM/JSKMR	
LENGTH	23 FT	7.0104 M	
WEIGHT	7999.04 LB	3628.36 KG	3.571 LT
SPEED	65.1 KT	33.5135 M/S	109.954 F/S
POWER	880 HP	656.216 KW	
THRUST	0 LB	0 KN	
E=	1.8172	F= 4.04035	G= 7.34213
N 300		FRANCE SEDAM/JSKMR/MNTL	
LENGTH	78.9 FT	24.0487 M	
WEIGHT	62003.2 LB	28124.7 KG	27.68 LT
SPEED	62 KT	31.9176 M/S	104.718 F/S
POWER	2900 HP	2162.53 KW	
THRUST	0 LB	0 KN	
E=	4.07075	F= 2.07757	G= 8.45726
N 500		NAV.PLANE/JSKMR/MNTL	
LENGTH	177.2 FT	54.0106 M	
WEIGHT	473984 LB	214999. KG	211.6 LT
SPEED	76 KT	39.1248 M/S	128.364 F/S
POWER	12500 HP	9321.25 KW	
THRUST	0 LB	0 KN	
E=	8.84982	F= 1.69935	G= 15.039
VT-1		JSKMR/MNTL	
LENGTH	95.5 FT	29.1084 M	
WEIGHT	194880 LB	88397.6 KG	87 LT
SPEED	48 KT	24.7104 M/S	81.072 F/S
POWER	4000 HP	2982.8 KW	
THRUST	0 LB	0 KN	
E=	7.18151	F= 1.46198	G= 10.4992
CC-7		JSKMR/MNTL	
LENGTH	25.8 FT	7.86384 M	
WEIGHT	6500.48 LB	2948.62 KG	2.902 LT
SPEED	40 KT	20.592 M/S	67.56 F/S
POWER	390 HP	290.823 KW	
THRUST	0 LB	0 KN	
E=	2.04742	F= 2.34397	G= 4.7991

SRN-1	BHC MK-1/JSKMR/JAWACHCHF		
LENGTH	31.4 FT	9.57072 M	
WEIGHT	12992 LB	5893.17 KG	5.8 LT
SPEED	45 KT	23.166 M/S	76.005 F/S
POWER	435 HP	324.38 KW	
THRUST	0 LB	0 KN	
E=	4.1273	F= 2.39028	G= 9.86542
VA-4	JSKMR		
LENGTH	133 FT	40.5384 M	
WEIGHT	336000 LB	152410. KG	150 LT
SPEED	70 KT	36.036 M/S	118.23 F/S
POWER	10200 HP	7606.14 KW	
THRUST	0 LB	0 KN	
E=	7.08116	F= 1.80665	G= 12.7932
SRN-4	BHC/JSKMR/MNTL		
LENGTH	130.2 FT	39.685 M	
WEIGHT	402976 LB	182790. KG	179.9 LT
SPEED	77 KT	39.6396 M/S	130.053 F/S
POWER	17000 HP	12676.9 KW	
THRUST	0 LB	0 KN	
E=	5.60516	F= 2.00857	G= 11.2584
SRN-5	BHC/JSKMR		
LENGTH	38.75 FT	11.811 M	
WEIGHT	15008 LB	6807.63 KG	6.7 LT
SPEED	66 KT	33.9768 M/S	111.474 F/S
POWER	1050 HP	782.985 KW	
THRUST	0 LB	0 KN	
E=	2.89697	F= 3.1558	G= 9.14227
SRN-6	BHC/JSKMR/MNTL		
LENGTH	48.4 FT	14.7523 M	
WEIGHT	23990.4 LB	10882. KG	10.71 LT
SPEED	60 KT	30.888 M/S	101.34 F/S
POWER	1050 HP	782.985 KW	
THRUST	0 LB	0 KN	
E=	4.20985	F= 2.56703	G= 10.8068
BH-7	JSKMR/MNTL		
LENGTH	78.3 FT	23.8658 M	
WEIGHT	114240 LB	51819.3 KG	51 LT
SPEED	65 KT	33.462 M/S	109.785 F/S
POWER	4250 HP	3169.23 KW	
THRUST	0 LB	0 KN	
E=	5.36549	F= 2.18642	G= 11.7312
SKMR-1	JSKMR		
LENGTH	65.5 FT	19.9644 M	
WEIGHT	64960 LB	29465.9 KG	29 LT
SPEED	80 KT	41.184 M/S	135.12 F/S
POWER	4320 HP	3221.42 KW	
THRUST	0 LB	0 KN	
E=	3.69419	F= 2.94219	G= 10.869
VT-2	VOSPER-THORNYCROFT/JSKMR/MNTL		
LENGTH	99 FT	30.1752 M	
WEIGHT	140000 LB	63504 KG	62.5 LT
SPEED	60 KT	30.888 M/S	101.34 F/S
POWER	7600 HP	5667.32 KW	
THRUST	0 LB	0 KN	
E=	3.39416	F= 1.79488	G= 6.09211

JEFF-A NAVY LAND CR/MNTL/CLASS V  
 LENGTH 99 FT 30.1752 M  
 WEIGHT 332864 LB 150987. KG 148.6 LT  
 SPEED 50 KT 25.74 M/S 84.45 F/S  
 POWER 14000 HP 10439.8 KW  
 THRUST 0 LB 0 KN  
 E= 3.6507 F= 1.49573 G= 5.46047

JEFF-B NAVY LAND CR/MNTL/CLASS V  
 LENGTH 86.75 FT 26.4414 M  
 WEIGHT 325024 LB 147431. KG 145.1 LT  
 SPEED 50 KT 25.74 M/S 84.45 F/S  
 POWER 16800 HP 12527.8 KW  
 THRUST 0 LB 0 KN  
 E= 2.97059 F= 1.59785 G= 4.74657

MITSUI MV-PP15 JAPAN/MNTL/JSKMR  
 LENGTH 81.1 FT 24.7193 M  
 WEIGHT 112000 LB 50803.2 KG 50 LT  
 SPEED 60 KT 30.888 M/S 101.34 F/S  
 POWER 3900 HP 2908.23 KW  
 THRUST 0 LB 0 KN  
 E= 5.29141 F= 1.98309 G= 10.4934

MITSUI MV-PP5 JAPAN/MNTL/JSKMR  
 LENGTH 52.5 FT 16.002 M  
 WEIGHT 26880 LB 12192.8 KG 12 LT  
 SPEED 55 KT 28.314 M/S 92.895 F/S  
 POWER 1050 HP 782.985 KW  
 THRUST 0 LB 0 KN  
 E= 4.32384 F= 2.25936 G= 9.7691

EVERGLADE SPEEDSTER WEILAND/HCHF 62  
 LENGTH 31 FT 9.4488 M  
 WEIGHT 4000.64 LB 1814.69 KG 1.786 LT  
 SPEED 65.1 KT 33.5135 M/S 109.954 F/S  
 POWER 300 HP 223.71 KW  
 THRUST 0 LB 0 KN  
 E= 2.66598 F= 3.48018 G= 9.27808

JL3 - SURFACE EFFECT SHIP

HM-2	HOVERMARINE/JSKMR/MNTL		
LENGTH	51 FT	15.5448 M	
WEIGHT	44508.8 LB	20189.2 KG	19.87 LT
SPEED	35 KT	18.018 M/S	59.115 F/S
POWER	825 HP	615.202 KW	
THRUST	0 LB	0 KN	
E=	5.79865	F= 1.45876	G= 8.45886

SES-100A	NAVY AEROJET/JSKMR/MNTL/HCHF		
LENGTH	81.9 FT	24.9631 M	
WEIGHT	225792 LB	102419. KG	100.8 LT
SPEED	82 KT	42.2136 M/S	138.498 F/S
POWER	14000 HP	10439.8 KW	
THRUST	0 LB	0 KN	
E=	4.05126	F= 2.69695	G= 10.953

SES-100B	NAVY BELL/JSKMR/MNTL/HCHF		
LENGTH	77.8 FT	23.7134 M	
WEIGHT	192774. LB	87442.5 KG	86.06 LT
SPEED	90.3 KT	46.4864 M/S	152.517 F/S
POWER	14030 HP	10462.2 KW	
THRUST	0 LB	0 KN	
E=	3.81019	F= 3.04719	G= 11.6104



# JN1 - WING-IN-SURFACE-EFFECT

KAARIO	FINN RAM WING SLED/LPSCH/W ?		
LENGTH	26.41 FT	8.04977 M	
WEIGHT	1102 LB	499.867 KG	0.491964 LT
SPEED	43.2 KT	22.2394 M/S	72.9648 F/S
POWER	50 HP	37.285 KW	
THRUST	0 LB	0 KN	
E=	2.9239	F= 2.50208	G= 7.31583

X-112	LIPPISCH/COLLINS/LPSCH		
LENGTH	25 FT	7.62 M	
WEIGHT	727.5 LB	329.994 KG	0.324777 LT
SPEED	69.47 KT	35.7632 M/S	117.335 F/S
POWER	25 HP	18.6425 KW	
THRUST	0 LB	0 KN	
E=	6.20808	F= 4.13551	G= 25.6736

X-113	LIPPISCH/RHEINFZB/JSKMR/LPSCH		
LENGTH	27.8 FT	8.47344 M	
WEIGHT	760 LB	344.736 KG	0.339286 LT
SPEED	92 KT	47.3616 M/S	155.388 F/S
POWER	44 HP	32.8108 KW	
THRUST	0 LB	0 KN	
E=	4.87995	F= 5.19358	G= 25.3444

RAM II	AUSTIN AEROMARINE/HCHF 74		
LENGTH	25.4 FT	7.74192 M	
WEIGHT	3584 LB	1625.7 KG	1.6 LT
SPEED	95.3 KT	49.0604 M/S	160.962 F/S
POWER	270 HP	201.339 KW	
THRUST	0 LB	0 KN	
E=	3.88476	F= 5.62831	G= 21.8646

KUDU I	OPEN SEA RACE BOAT/LECT NOTES		
LENGTH	34 FT	10.3632 M	
WEIGHT	10800 LB	4898.88 KG	4.82143 LT
SPEED	77 KT	39.6396 M/S	130.053 F/S
POWER	1360 HP	1014.15 KW	
THRUST	0 LB	0 KN	
E=	1.87777	F= 3.93055	G= 7.38067

KUDU II	RAM WING/COOK		
LENGTH	34 FT	10.3632 M	
WEIGHT	11900 LB	5397.84 KG	5.3125 LT
SPEED	85 KT	43.758 M/S	143.565 F/S
POWER	1300 HP	969.41 KW	
THRUST	0 LB	0 KN	
E=	2.3894	F= 4.33892	G= 10.3674

RAM WING 63	MANNED/HCHF 74		
LENGTH	26 FT	7.9248 M	
WEIGHT	1100 LB	498.96 KG	0.491071 LT
SPEED	70 KT	36.036 M/S	118.23 F/S
POWER	100 HP	74.57 KW	
THRUST	0 LB	0 KN	
E=	2.3646	F= 4.08614	G= 9.66208

KAG-3	JAPAN 63/HCHF 74		
LENGTH	19.3 FT	5.88264 M	
WEIGHT	1410 LB	639.576 KG	0.629464 LT
SPEED	46 KT	23.6808 M/S	77.694 F/S
POWER	80 HP	59.656 KW	
THRUST	0 LB	0 KN	
E=	2.48974	F= 3.1166	G= 7.75952

RAM WING 64      MANNED/HCHF 74		
LENGTH 31 FT	9.4488 M	
WEIGHT 4500 LB	2041.2 KG	2.00893 LT
SPEED 56 KT	28.8288 M/S	94.584 F/S
POWER 279 HP	208.05 KW	
THRUST 0 LB	0 KN	
E= 2.77372	F= 2.9937	G= 8.30371
COLUMBIA      1965/HCHF 74		
LENGTH 180 FT	54.864 M	
WEIGHT 220500 LB	100019. KG	98.4375 LT
SPEED 73 KT	37.5804 M/S	123.297 F/S
POWER 13620 HP	10156.4 KW	
THRUST 0 LB	0 KN	
E= 3.62929	F= 1.61953	G= 5.87773
LOCKHEED 63      HCHF 74		
LENGTH 13 FT	3.9624 M	
WEIGHT 1500 LB	680.4 KG	0.669643 LT
SPEED 45 KT	23.166 M/S	76.005 F/S
POWER 75 HP	55.9275 KW	
THRUST 0 LB	0 KN	
E= 2.76382	F= 3.71486	G= 10.2672
RAM WING 65      MANNED./HCHF 74		
LENGTH 18.7 FT	5.69976 M	
WEIGHT 970 LB	439.992 KG	0.433036 LT
SPEED 59 KT	30.3732 M/S	99.651 F/S
POWER 190 HP	141.683 KW	
THRUST 0 LB	0 KN	
E= 0.92499	F= 4.061	G= 3.75638
WEILAND 64      HCHF 74		
LENGTH 51.8 FT	15.7886 M	
WEIGHT 9480 LB	4300.13 KG	4.23214 LT
SPEED 80 KT	41.184 M/S	135.12 F/S
POWER 520 HP	387.764 KW	
THRUST 0 LB	0 KN	
E= 4.4788	F= 3.30847	G= 14.818
OUUM-2      65 USSR F-2/HCHF 74		
LENGTH 16.4 FT	4.99872 M	
WEIGHT 990 LB	449.064 KG	0.441964 LT
SPEED 59 KT	30.3732 M/S	99.651 F/S
POWER 36 HP	26.8452 KW	
THRUST 0 LB	0 KN	
E= 4.98255	F= 4.33642	G= 21.6065
PROJECT 1*      HCHF 74		
LENGTH 160 FT	48.768 M	
WEIGHT 606400 LB	275063. KG	270.714 LT
SPEED 150 KT	77.22 M/S	253.35 F/S
POWER 32600 HP	24309.8 KW	
THRUST 0 LB	0 KN	
E= 8.5684	F= 3.52966	G= 30.2436
PROJECT 2*      HCHF 74		
LENGTH 459 FT	139.903 M	
WEIGHT 3970000 LB	1800792 KG	1772.32 LT
SPEED 100 KT	51.48 M/S	168.9 F/S
POWER 200000 HP	149140 KW	
THRUST 0 LB	0 KN	
E= 6.09575	F= 1.3893	G= 8.46882
WEILAND PROJECT*      HCHF 74		
LENGTH 700 FT	213.36 M	
WEIGHT 220500 LB	100019. KG	98.4375 LT
SPEED 100 KT	51.48 M/S	168.9 F/S
POWER 200000 HP	149140 KW	
THRUST 0 LB	0 KN	
E= 0.338568	F= 1.125	G= 0.380889

# JN2 - HELICOPTER

S-58 SIKORSKY SEABAT/JAWAC 59-60		
LENGTH	56.7 FT	17.2822 M
WEIGHT	14000 LB	6350.4 KG 6.25 LT
SPEED	107 KT	55.0836 M/S 180.723 F/S
POWER	1525 HP	1137.19 KW
THRUST	0 LB	0 KN
E=	3.01654	F= 4.22955 G= 12.7586

AH-IJ SEA COBRA JAWAC		
LENGTH	53.25 FT	16.2306 M
WEIGHT	10000 LB	4536 KG 4.46429 LT
SPEED	180 KT	92.664 M/S 304.02 F/S
POWER	1800 HP	1342.26 KW
THRUST	0 LB	0 KN
E=	3.07091	F= 7.342 G= 22.5466

SH-3 SEA KING SIKORSKY/JAWAC		
LENGTH	72.67 FT	22.1498 M
WEIGHT	20500 LB	9298.8 KG 9.15179 LT
SPEED	144 KT	74.1312 M/S 243.216 F/S
POWER	2800 HP	2087.96 KW
THRUST	0 LB	0 KN
E=	3.23762	F= 5.0279 G= 16.2784

UH-46D SEA KNIGHT JAWAC		
LENGTH	77.83 FT	23.7226 M
WEIGHT	23000 LB	10432.8 KG 10.2679 LT
SPEED	144 KT	74.1312 M/S 243.216 F/S
POWER	2800 HP	2087.96 KW
THRUST	0 LB	0 KN
E=	3.63245	F= 4.85837 G= 17.6478

UH-2A/B SEA SPRITE KAMAN/JAWAC 64-65		
LENGTH	52.58 FT	16.0264 M
WEIGHT	10000 LB	4536 KG 4.46429 LT
SPEED	141 KT	72.5868 M/S 238.149 F/S
POWER	1250 HP	932.125 KW
THRUST	0 LB	0 KN
E=	3.46399	F= 5.78776 G= 20.0487

CH-53 SEA STALLION SIKORSKY/JAWAC		
LENGTH	88.25 FT	26.8986 M
WEIGHT	42000 LB	19051.2 KG 18.75 LT
SPEED	170 KT	87.516 M/S 287.13 F/S
POWER	5700 HP	4250.49 KW
THRUST	0 LB	0 KN
E=	3.84672	F= 5.38633 G= 20.7197

WH-IE IROQUOIS BELL/JAWAC		
LENGTH	53 FT	16.1544 M
WEIGHT	9500 LB	4309.2 KG 4.24107 LT
SPEED	140 KT	72.072 M/S 236.46 F/S
POWER	1100 HP	820.27 KW
THRUST	0 LB	0 KN
E=	3.71301	F= 5.7239 G= 21.2529

QH-50C GYRODYNE		JAWAC 60-61
LENGTH 20 FT	6.096 M	
WEIGHT 2285 LB	1036.48 KG	1.02009 LT
SPEED 80 KT	41.184 M/S	135.12 F/S
POWER 300 HP	223.71 KW	
THRUST 0 LB	0 KN	
E= 1.87121	F= 5.32447	G= 9.96319
QC-50D GYRODYNE DASH		JAWAC 60-61
LENGTH 20 FT	6.096 M	
WEIGHT 2328 LB	1055.98 KG	1.03929 LT
SPEED 80 KT	41.184 M/S	135.12 F/S
POWER 365 HP	272.181 KW	
THRUST 0 LB	0 KN	
E= 1.56692	F= 5.32447	G= 8.34303
ROTODYNE FAIREY/JAWAC/ROT DIAM		
LENGTH 104 FT	31.6992 M	
WEIGHT 50000 LB	22680 KG	22.3214 LT
SPEED 174.6 KT	89.8841 M/S	294.899 F/S
POWER 10500 HP	7829.85 KW	
THRUST 0 LB	0 KN	
E= 2.55324	F= 5.096	G= 13.0113
MI-4 HOUND USSR/JAWAC/ROT DIA		
LENGTH 68.92 FT	21.0068 M	
WEIGHT 15875 LB	7200.9 KG	7.08705 LT
SPEED 100.7 KT	51.8404 M/S	170.082 F/S
POWER 1700 HP	1267.69 KW	
THRUST 0 LB	0 KN	
E= 2.88776	F= 3.61043	G= 10.426
YAK-24 HORSE USSR/JAWAC/2 ROTORS		
LENGTH 92 FT	28.0416 M	
WEIGHT 32275 LB	14639.9 KG	14.4085 LT
SPEED 137.2 KT	70.6306 M/S	231.731 F/S
POWER 3400 HP	2535.38 KW	
THRUST 0 LB	0 KN	
E= 3.99952	F= 4.25757	G= 17.0283
H-13 SOUX BELL/JAWAC		
LENGTH 41.5 FT	12.6492 M	
WEIGHT 2450 LB	1111.32 KG	1.09375 LT
SPEED 74.69 KT	38.4504 M/S	126.151 F/S
POWER 200 HP	149.14 KW	
THRUST 0 LB	0 KN	
E= 2.80974	F= 3.45096	G= 9.69629
RANGER 47J BELL/CG HUL 1C/JAWAC		
LENGTH 43.35 FT	13.2131 M	
WEIGHT 2800 LB	1270.08 KG	1.25 LT
SPEED 95.5 KT	49.1634 M/S	161.299 F/S
POWER 260 HP	193.882 KW	
THRUST 0 LB	0 KN	
E= 3.15831	F= 4.31728	G= 13.6353
B-8M GYRO-COPTER BENSON/JAWAC/ROT DIA		
LENGTH 20 FT	6.096 M	
WEIGHT 500 LB	226.8 KG	0.223214 LT
SPEED 73.8 KT	37.9922 M/S	124.648 F/S
POWER 72 HP	53.6904 KW	
THRUST 0 LB	0 KN	
E= 1.57384	F= 4.91183	G= 7.73043

X-18 VTO		HILLER/JAWAC	
LENGTH	63 FT	19.2024 M	
WEIGHT	33000 LB	14968.8 KG	14.7321 LT
SPEED	217.1 KT	111.763 M/S	366.682 F/S
POWER	11700 HP	8724.69 KW	
THRUST	0 LB	0 KN	
E=	1.88042	F= 8.14125	G= 15.309
H-13 RAVEN		UH-2 (HTC) HILLER/JAWAC/ROT DIA	
LENGTH	35 FT	10.668 M	
WEIGHT	2700 LB	1224.72 KG	1.20536 LT
SPEED	82.5 KT	42.471 M/S	139.342 F/S
POWER	250 HP	186.425 KW	
THRUST	0 LB	0 KN	
E=	2.73618	F= 4.1507	G= 11.3571
H-43 HUSKIE		KAMAN/JAWAC/ROT DIA	
LENGTH	47 FT	14.3256 M	
WEIGHT	6948 LB	3151.61 KG	3.10179 LT
SPEED	104.2 KT	53.6422 M/S	175.994 F/S
POWER	720 HP	536.904 KW	
THRUST	0 LB	0 KN	
E=	3.08789	F= 4.52398	G= 13.9696
RH-1 PINWHEEL		ROTOR-CRAFT/JAWAC/ROT DIA	
LENGTH	16 FT	4.8768 M	
WEIGHT	400 LB	181.44 KG	0.178571 LT
SPEED	56.4 KT	29.0347 M/S	95.2596 F/S
POWER	0 HP	0 KW	
THRUST	40 LB	0.177936 KN	
E=	10	F= 4.19682	G= 41.9682
CG HH52A		SIKORSKY S-62A/FLYING LIFEBOAT/JAWAC 64-65	
LENGTH	62.3 FT	18.989 M	
WEIGHT	8300 LB	3764.88 KG	3.70536 LT
SPEED	112.9 KT	58.1209 M/S	190.688 F/S
POWER	1050 HP	782.985 KW	
THRUST	0 LB	0 KN	
E=	2.74063	F= 4.25747	G= 11.6681
CG HH3F PELICAN		SIKORSKY/JAWAC/CG AIR	
LENGTH	73 FT	22.2504 M	
WEIGHT	22050 LB	10001.9 KG	9.84375 LT
SPEED	142 KT	73.1016 M/S	239.838 F/S
POWER	2500 HP	1864.25 KW	
THRUST	0 LB	0 KN	
E=	3.84613	F= 4.94685	G= 19.0262
S-55		SIKORSKY (CG H04S)/JAWAC/ROT DIA	
LENGTH	53 FT	16.1544 M	
WEIGHT	7900 LB	3583.44 KG	3.52679 LT
SPEED	97.3 KT	50.09 M/S	164.34 F/S
POWER	700 HP	521.99 KW	
THRUST	0 LB	0 KN	
E=	3.37217	F= 3.97811	G= 13.4148
VERTOL MODEL 44		JAWAC	
LENGTH	73 FT	22.2504 M	
WEIGHT	15000 LB	6804 KG	6.69643 LT
SPEED	110.3 KT	56.7824 M/S	186.297 F/S
POWER	900 HP	671.13 KW	
THRUST	0 LB	0 KN	
E=	5.64535	F= 3.84252	G= 21.6924

S-64A SKYCRANE SIKORSKY/JAWAC

LENGTH	88.6 FT	27.0053 M	
WEIGHT	38000 LB	17236.8 KG	16.9643 LT
SPEED	101.6 KT	52.3037 M/S	171.602 F/S
POWER	8100 HP	6040.17 KW	
THRUST	0 LB	0 KN	
E=	1.46372	F= 3.21276	G= 4.7026

KELLETT KD-1A AUTOGYRO/JAWAC/ROT DIA

LENGTH	40 FT	12.192 M	
WEIGHT	2200 LB	997.92 KG	0.982143 LT
SPEED	108.6 KT	55.9073 M/S	183.425 F/S
POWER	225 HP	167.783 KW	
THRUST	0 LB	0 KN	
E=	3.2609	F= 5.11095	G= 16.6663

UMBAUGH AUTOGYRO/JAWAC 63-64

LENGTH	21 FT	6.4008 M	
WEIGHT	1800 LB	816.48 KG	0.803571 LT
SPEED	109.4 KT	56.3191 M/S	184.777 F/S
POWER	180 HP	134.226 KW	
THRUST	0 LB	0 KN	
E=	3.35957	F= 7.10574	G= 23.8723

MINCOPER SO AFRICA AUTOGYRO/ROTORCRAFT/JAWAC/ROT DIA

LENGTH	21.5 FT	6.5532 M	
WEIGHT	550 LB	249.48 KG	0.245536 LT
SPEED	86.8 KT	44.6846 M/S	146.605 F/S
POWER	72 HP	53.6904 KW	
THRUST	0 LB	0 KN	
E=	2.03618	F= 5.57189	G= 11.3454

WALLIS WA-116 UK/JAWAC 64-65/AUTOGYRO/ROT DIA

LENGTH	20.33 FT	6.19658 M	
WEIGHT	655 LB	297.108 KG	0.292411 LT
SPEED	99.9 KT	51.4285 M/S	168.731 F/S
POWER	72 HP	53.6904 KW	
THRUST	0 LB	0 KN	
E=	2.79088	F= 6.59475	G= 18.4052

JP1 - HISTORICAL AIRPLANE

WRIGHT FLYER 1903/GARBER/JA 100  
 LENGTH 21.1 FT 6.43128 M  
 WEIGHT 750 LB 340.2 KG 0.334821 LT  
 SPEED 26 KT 13.3848 M/S 43.914 F/S  
 POWER 12 HP 8.9484 KW  
 THRUST 0 LB 0 KN  
 E= 4.99023 F= 1.68474 G= 8.40725

NC-4 NAVY-CURTISS/NSRDC  
 LENGTH 68.3 FT 20.8178 M  
 WEIGHT 28500 LB 12927.6 KG 12.7232 LT  
 SPEED 84.1 KT 43.2947 M/S 142.045 F/S  
 POWER 1400 HP 1043.98 KW  
 THRUST 0 LB 0 KN  
 E= 5.25751 F= 3.02892 G= 15.9245

TIN GOOSE FORD/STOUT TRIMOTOR/JA 100  
 LENGTH 49.8 FT 15.179 M  
 WEIGHT 10130 LB 4594.97 KG 4.52232 LT  
 SPEED 115 KT 59.202 M/S 194.235 F/S  
 POWER 900 HP 671.13 KW  
 THRUST 0 LB 0 KN  
 E= 3.97495 F= 4.85048 G= 19.2804

ANTOINETTE V/VI JAWAC 09  
 LENGTH 37.75 FT 11.5062 M  
 WEIGHT 1444 LB 654.998 KG 0.644643 LT  
 SPEED 39.1 KT 20.1287 M/S 66.0399 F/S  
 POWER 50 HP 37.285 KW  
 THRUST 0 LB 0 KN  
 E= 3.4677 F= 1.89417 G= 6.56842

BLERIOT XI JAWAC 09/V IS HIGHER  
 LENGTH 23 FT 7.0104 M  
 WEIGHT 660 LB 299.376 KG 0.294643 LT  
 SPEED 39.1 KT 20.1287 M/S 66.0399 F/S  
 POWER 25 HP 18.6425 KW  
 THRUST 0 LB 0 KN  
 E= 3.16992 F= 2.42669 G= 7.69241

LA DEMOISELLE SANTOS DUMONT/JAWAC  
 LENGTH 19.7 FT 6.00456 M  
 WEIGHT 330 LB 149.688 KG 0.147321 LT  
 SPEED 48.6 KT 25.0193 M/S 82.0854 F/S  
 POWER 25 HP 18.6425 KW  
 THRUST 0 LB 0 KN  
 E= 1.97005 F= 3.25915 G= 6.42069

FARMAN BIPLANE VOISIN TYPE/JAWAC		
LENGTH 35.1 FT	10.6985 M	
WEIGHT 990 LB	449.064 KG	0.441964 LT
SPEED 43.4 KT	22.3423 M/S	73.3026 F/S
POWER 60 HP	44.742 KW	
THRUST 0 LB	0 KN	
E= 2.19908	F= 2.18041	G= 4.79489

VOISIN BIPLANE BOXWING/JAWAC		
LENGTH 37.8 FT	11.5214 M	
WEIGHT 1200 LB	544.32 KG	0.535714 LT
SPEED 36.5 KT	18.7902 M/S	61.6485 F/S
POWER 39 HP	29.0823 KW	
THRUST 0 LB	0 KN	
E= 3.44887	F= 1.76705	G= 6.09432

CURTISS BIPLANE JAWAC		
LENGTH 33.5 FT	10.2108 M	
WEIGHT 710 LB	322.056 KG	0.316964 LT
SPEED 39.1 KT	20.1287 M/S	66.0399 F/S
POWER 30 HP	22.371 KW	
THRUST 0 LB	0 KN	
E= 2.84172	F= 2.01074	G= 5.71396

MEGALIFTER* DESIGN CONCEPT/AV WK 26 JUL 74		
LENGTH 650 FT	198.12 M	
WEIGHT 1000000 LB	453600 KG	446.429 LT
SPEED 178 KT	91.6344 M/S	300.642 F/S
POWER 0 HP	0 KW	
THRUST 164400 LB	731.317 KN	
E= 6.08273	F= 2.07809	G= 12.6405



JP2 - SEAPLANE

PBY CONSOLIDTD MOD 28 CATALINA FLYING BOAT/JAWAC  
 LENGTH 65.1 FT 19.8425 M  
 WEIGHT 27080 LB 12283.5 KG 12.0893 LT  
 SPEED 165 KT 84.942 M/S 278.685 F/S  
 POWER 2000 HP 1491.4 KW  
 THRUST 0 LB 0 KN  
 E= 6.86072 F= 6.08689 G= 41.7604

PBM-5 JAWAC 51-52  
 LENGTH 79.8 FT 24.323 M  
 WEIGHT 56000 LB 25401.6 KG 25 LT  
 SPEED 174 KT 89.5752 M/S 293.886 F/S  
 POWER 4200 HP 3131.94 KW  
 THRUST 0 LB 0 KN  
 E= 7.12451 F= 5.79762 G= 41.3052

R3Y-1 JAWAC  
 LENGTH 142.5 FT 43.434 M  
 WEIGHT 160000 LB 72576 KG 71.4286 LT  
 SPEED 304 KT 156.499 M/S 513.456 F/S  
 POWER 22000 HP 16405.4 KW  
 THRUST 0 LB 0 KN  
 E= 6.7895 F= 7.57998 G= 51.4643

PSM-2 MARTIN MARLIN/JAWAC  
 LENGTH 100.6 FT 30.6629 M  
 WEIGHT 72800 LB 33022.1 KG 32.5 LT  
 SPEED 213 KT 109.652 M/S 359.757 F/S  
 POWER 6900 HP 5145.33 KW  
 THRUST 0 LB 0 KN  
 E= 6.90127 F= 6.32095 G= 43.6226

CLIPPER -314A/JAWAC  
 LENGTH 106 FT 32.3088 M  
 WEIGHT 84000 LB 38102.4 KG 37.5 LT  
 SPEED 182.4 KT 93.8995 M/S 308.074 F/S  
 POWER 6400 HP 4772.48 KW  
 THRUST 0 LB 0 KN  
 E= 7.35176 F= 5.27319 G= 38.7672

MADGE USSR BE-6/JAWAC 59-60  
 LENGTH 84 FT 25.6032 M  
 WEIGHT 51588 LB 23400.3 KG 23.0304 LT  
 SPEED 224.1 KT 115.367 M/S 378.505 F/S  
 POWER 4000 HP 2982.8 KW  
 THRUST 0 LB 0 KN  
 E= 8.8756 F= 7.27786 G= 64.5954

P6M-2 MARTIN SEA MASTER/JAWAC 59-60  
 LENGTH 134 FT 40.8432 M  
 WEIGHT 160000 LB 72576 KG 71.4286 LT  
 SPEED 521 KT 268.211 M/S 879.969 F/S  
 POWER 0 HP 0 KW  
 THRUST 98000 LB 435.943 KN  
 E= 1.63265 F= 13.3964 G= 21.8716

ALBATROSS COAST GUARD/GRUMMAN HU-16E AMPHIBIAN/CG AIR  
 LENGTH 63 FT 19.2024 M  
 WEIGHT 37500 LB 17010 KG 16.7411 LT  
 SPEED 254 KT 130.759 M/S 429.006 F/S  
 POWER 2850 HP 2125.24 KW  
 THRUST 0 LB 0 KN  
 E= 10.2633 F= 9.525 G= 97.758

SUPER CATALINA CANADA TIMMINS PBV-5A/JAWAC

LENGTH	62.875 FT	19.1643 M	
WEIGHT	32000 LB	14515.2 KG	14.2857 LT
SPEED	179.8 KT	92.561 M/S	303.682 F/S
POWER	3400 HP	2535.38 KW	
THRUST	0 LB	0 KN	
E=	5.1967	F= 6.7492	G= 35.0736

SPORTSMAN VOLMER VJ22/JAWAC

LENGTH	24 FT	7.3152 M	
WEIGHT	1500 LB	680.4 KG	0.669643 LT
SPEED	82.5 KT	42.471 M/S	139.342 F/S
POWER	1500 HP	1118.55 KW	
THRUST	0 LB	0 KN	
E=	0.25335	F= 5.01245	G= 1.2699

JP3 - SURVEILLANCE/OBSERVATION

STALLION HELIO H-550A/USAF AU-24A/JAWAC

LENGTH	39.6 FT	12.0701 M	
WEIGHT	5100 LB	2313.36 KG	2.27679 LT
SPEED	188 KT	96.7824 M/S	317.532 F/S
POWER	680 HP	507.076 KW	
THRUST	0 LB	0 KN	
E=	4.32998	F= 8.89226	G= 38.5033

SUPER COURIER HELIO H-295/USAF U-10A/JAWAC

LENGTH	31 FT	9.4488 M	
WEIGHT	3400 LB	1542.24 KG	1.51786 LT
SPEED	145 KT	74.646 M/S	244.905 F/S
POWER	295 HP	219.982 KW	
THRUST	0 LB	0 KN	
E=	5.13206	F= 7.75156	G= 39.7815

HU 25A COAST GUARD/FALCON 20/CG AIR

LENGTH	56.25 FT	17.145 M	
WEIGHT	30500 LB	13834.8 KG	13.6161 LT
SPEED	350 KT	180.18 M/S	591.15 F/S
POWER	0 HP	0 KW	
THRUST	8100 LB	36.032 KN	
E=	3.76543	F= 13.8902	G= 52.3026

OV-1C GRUMMAN/JAWAC

LENGTH	41.1 FT	12.5273 M	
WEIGHT	19230 LB	8722.73 KG	8.58482 LT
SPEED	267 KT	137.452 M/S	450.963 F/S
POWER	2800 HP	2087.96 KW	
THRUST	0 LB	0 KN	
E=	5.63118	F= 12.3963	G= 69.8058

OV-1D MOHAWK/JAWAC

LENGTH	43 FT	13.1064 M	
WEIGHT	18109 LB	8214.24 KG	8.08438 LT
SPEED	335 KT	172.458 M/S	565.815 F/S
POWER	2800 HP	2087.96 KW	
THRUST	0 LB	0 KN	
E=	6.65347	F= 15.2059	G= 101.172

OV-10A BRONCO/JAWAC

LENGTH	41.6 FT	12.6797 M	
WEIGHT	14466 LB	6561.78 KG	6.45804 LT
SPEED	244 KT	125.611 M/S	412.116 F/S
POWER	1430 HP	1066.35 KW	
THRUST	0 LB	0 KN	
E=	7.58	F= 11.2602	G= 85.3521

JP4 - LIGHT AIRPLANE

AERONCA	BEECHCRAFT/JAWAC	
LENGTH 21 FT	6.4008 M	
WEIGHT 1250 LB	567 KG	0.558036 LT
SPEED 95 KT	48.906 M/S	160.455 F/S
POWER 65 HP	48.4705 KW	
THRUST 0 LB	0 KN	
E= 5.61031	F= 6.17043	G= 34.6181

99AL	BEECH/JAWAC/JA100	
LENGTH 44.5 FT	13.5636 M	
WEIGHT 10900 LB	4944.24 KG	4.86607 LT
SPEED 243 KT	125.096 M/S	410.427 F/S
POWER 1360 HP	1014.15 KW	
THRUST 0 LB	0 KN	
E= 5.98082	F= 10.8425	G= 64.8468

SNB-1	BEECH/KANSAN TRAINER/JAWAC 45-46	
LENGTH 34.33 FT	10.4638 M	
WEIGHT 6130 LB	2780.57 KG	2.73661 LT
SPEED 186.7 KT	96.1132 M/S	315.336 F/S
POWER 900 HP	671.13 KW	
THRUST 0 LB	0 KN	
E= 3.90507	F= 9.48438	G= 37.0372

T34C	BEECH/MENTOR/TRAINER/JAWAC	
LENGTH 28.7 FT	8.74776 M	
WEIGHT 4000 LB	1814.4 KG	1.78571 LT
SPEED 223 KT	114.8 M/S	376.647 F/S
POWER 400 HP	298.28 KW	
THRUST 0 LB	0 KN	
E= 6.84813	F= 12.3898	G= 84.8472

SUNDOWNER 180	BEECH/JAWAC	
LENGTH 25.7 FT	7.83336 M	
WEIGHT 2450 LB	1111.32 KG	1.09375 LT
SPEED 120 KT	61.776 M/S	202.68 F/S
POWER 180 HP	134.226 KW	
THRUST 0 LB	0 KN	
E= 5.01582	F= 7.04557	G= 35.3393

BONANZA F33A/C	BEECH/JAWAC	
LENGTH 25.5 FT	7.7724 M	
WEIGHT 3400 LB	1542.24 KG	1.51786 LT
SPEED 181 KT	93.1788 M/S	305.709 F/S
POWER 285 HP	212.524 KW	
THRUST 0 LB	0 KN	
E= 6.63101	F= 10.6687	G= 70.744

BONANZA A36	BEECH/JAWAC	
LENGTH 27.5 FT	8.382 M	
WEIGHT 3600 LB	1632.96 KG	1.60714 LT
SPEED 177 KT	91.1196 M/S	298.953 F/S
POWER 285 HP	212.524 KW	
THRUST 0 LB	0 KN	
E= 6.86591	F= 10.0464	G= 68.9773

BARON 58		BEECH/JAWAC	
LENGTH	29.8 FT	9.08304 M	
WEIGHT	5400 LB	2449.44 KG	2.41071 LT
SPEED	210 KT	108.108 M/S	354.69 F/S
POWER	570 HP	425.049 KW	
THRUST	0 LB	0 KN	
E=	6.10949	F= 11.4502	G= 69.9549
DUKE B60		BEECH/JAWAC	
LENGTH	33.8 FT	10.3022 M	
WEIGHT	6775 LB	3073.14 KG	3.02455 LT
SPEED	248 KT	127.67 M/S	418.872 F/S
POWER	760 HP	566.732 KW	
THRUST	0 LB	0 KN	
E=	6.78913	F= 12.6968	G= 86.2004
KING AIR E90		BEECH/JAWAC	
LENGTH	35.5 FT	10.8204 M	
WEIGHT	10100 LB	4581.36 KG	4.50893 LT
SPEED	249 KT	128.185 M/S	420.561 F/S
POWER	1360 HP	1014.15 KW	
THRUST	0 LB	0 KN	
E=	5.6787	F= 12.439	G= 70.6376
SUPERKING AIR 200		BEECH/JAWAC	
LENGTH	43.75 FT	13.335 M	
WEIGHT	12500 LB	5670 KG	5.58036 LT
SPEED	289 KT	148.777 M/S	488.121 F/S
POWER	1700 HP	1267.69 KW	
THRUST	0 LB	0 KN	
E=	6.52568	F= 13.005	G= 84.8665
CESSNA 150		JAWAC	
LENGTH	23.75 FT	7.239 M	
WEIGHT	1600 LB	725.76 KG	0.714286 LT
SPEED	106 KT	54.5688 M/S	179.034 F/S
POWER	100 HP	74.57 KW	
THRUST	0 LB	0 KN	
E=	5.20826	F= 6.47405	G= 33.7185
CESSNA 172		STANDARD/JAWAC	
LENGTH	26.9 FT	8.19912 M	
WEIGHT	2300 LB	1043.28 KG	1.02679 LT
SPEED	122 KT	62.8056 M/S	206.058 F/S
POWER	150 HP	111.855 KW	
THRUST	0 LB	0 KN	
E=	5.74465	F= 7.00141	G= 40.2206
CESSNA 172 E		T-41/JAWAC	
LENGTH	26.9 FT	8.19912 M	
WEIGHT	2550 LB	1156.68 KG	1.13839 LT
SPEED	133 KT	68.4684 M/S	224.637 F/S
POWER	210 HP	156.597 KW	
THRUST	0 LB	0 KN	
E=	4.95952	F= 7.63268	G= 37.8544

SKYWAGON 180 CESSNA/JAWAC  
 LENGTH 27.75 FT 8.4582 M  
 WEIGHT 2800 LB 1270.08 KG 1.25 LT  
 SPEED 148 KT 76.1904 M/S 249.972 F/S  
 POWER 230 HP 171.511 KW  
 THRUST 0 LB 0 KN  
 E= 5.53298 F= 8.36242 G= 46.2691

SKYLANE 182 CESSNA/JAWAC  
 LENGTH 28.2 FT 8.59536 M  
 WEIGHT 2950 LB 1338.12 KG 1.31696 LT  
 SPEED 146 KT 75.1608 M/S 246.594 F/S  
 POWER 230 HP 171.511 KW  
 THRUST 0 LB 0 KN  
 E= 5.75061 F= 8.18333 G= 47.0591

CENTURION I 210 CESSNA/JAWAC  
 LENGTH 28.25 FT 8.6106 M  
 WEIGHT 3800 LB 1723.68 KG 1.69643 LT  
 SPEED 174 KT 89.5752 M/S 293.886 F/S  
 POWER 300 HP 223.71 KW  
 THRUST 0 LB 0 KN  
 E= 6.76828 F= 9.7441 G= 65.9508

T310 USAF U-3/CESSNA/JAWAC  
 LENGTH 29.25 FT 8.9154 M  
 WEIGHT 5500 LB 2494.8 KG 2.45536 LT  
 SPEED 238 KT 122.522 M/S 401.982 F/S  
 POWER 570 HP 425.049 KW  
 THRUST 0 LB 0 KN  
 E= 7.05232 F= 13.0983 G= 92.3735

T318 USAFT-37B/CESSNA/JAWAC  
 LENGTH 29.25 FT 8.9154 M  
 WEIGHT 8007 LB 3631.98 KG 3.57455 LT  
 SPEED 312 KT 160.618 M/S 526.968 F/S  
 POWER 0 HP 0 KW  
 THRUST 2050 LB 9.11922 KN  
 E= 3.90585 F= 17.1709 G= 67.0671

SKYMASTER 337 USAF O-2/CESSNA/JAWAC  
 LENGTH 29.75 FT 9.0678 M  
 WEIGHT 4630 LB 2100.17 KG 2.06696 LT  
 SPEED 179 KT 92.1492 M/S 302.331 F/S  
 POWER 420 HP 313.194 KW  
 THRUST 0 LB 0 KN  
 E= 6.05971 F= 9.76813 G= 59.192

CESSNA 340 STANDARD/JAWAC  
 LENGTH 34.3 FT 10.4546 M  
 WEIGHT 5975 LB 2710.26 KG 2.66741 LT  
 SPEED 192 KT 98.8416 M/S 324.288 F/S  
 POWER 570 HP 425.049 KW  
 THRUST 0 LB 0 KN  
 E= 6.18061 F= 9.75789 G= 60.3097

GOLDEN EAGLE 421B CESSNA/JAWAC  
 LENGTH 36.1 FT 11.0033 M  
 WEIGHT 7450 LB 3379.32 KG 3.32589 LT  
 SPEED 245 KT 126.126 M/S 413.805 F/S  
 POWER 750 HP 559.275 KW  
 THRUST 0 LB 0 KN  
 E= 7.47357 F= 12.1371 G= 90.7073

CITATION 500 CESSNA/JAWAC  
 LENGTH 43.5 FT 13.2588 M  
 WEIGHT 11500 LB 5216.4 KG 5.13393 LT  
 SPEED 348 KT 179.15 M/S 587.772 F/S  
 POWER 0 HP 0 KW  
 THRUST 4400 LB 19.573 KN  
 E= 2.61364 F= 15.7049 G= 41.047

LEARJET 24D GATES/JAWAC			
LENGTH	43.25 FT	13.1826 M	
WEIGHT	13500 LB	6123.6 KG	6.02679 LT
SPEED	473 KT	243.5 M/S	798.897 F/S
POWER	0 HP	0 KW	
THRUST	5900 LB	26.2456 KN	
E=	2.28814	F= 21.4077	G= 48.9837
PIPER CUB JAWAC/JA100			
LENGTH	22.5 FT	6.858 M	
WEIGHT	925 LB	419.58 KG	0.412946 LT
SPEED	69 KT	35.5212 M/S	116.541 F/S
POWER	35 HP	26.0995 KW	
THRUST	0 LB	0 KN	
E=	5.60002	F= 4.32972	G= 24.2465
SUPER CUB 150 PIPER/JAWAC			
LENGTH	22.6 FT	6.88848 M	
WEIGHT	1750 LB	793.8 KG	0.78125 LT
SPEED	113 KT	58.1724 M/S	190.857 F/S
POWER	150 HP	111.855 KW	
THRUST	0 LB	0 KN	
E=	4.04848	F= 7.07499	G= 28.643
AZTEC E NAVY U-11A/JAWAC			
LENGTH	31.2 FT	9.50976 M	
WEIGHT	5200 LB	2358.72 KG	2.32143 LT
SPEED	188 KT	96.7824 M/S	317.532 F/S
POWER	500 HP	372.85 KW	
THRUST	0 LB	0 KN	
E=	6.00424	F= 10.018	G= 60.1507
CHEROKEE PA-28-235/JAWAC			
LENGTH	24.1 FT	7.34568 M	
WEIGHT	3000 LB	1360.8 KG	1.33929 LT
SPEED	140 KT	72.072 M/S	236.46 F/S
POWER	235 HP	175.24 KW	
THRUST	0 LB	0 KN	
E=	5.48843	F= 8.48831	G= 46.5875
CHEYENNE PA-31T/JAWAC			
LENGTH	34.7 FT	10.5766 M	
WEIGHT	9000 LB	4082.4 KG	4.01786 LT
SPEED	283 KT	145.688 M/S	477.987 F/S
POWER	1240 HP	924.668 KW	
THRUST	0 LB	0 KN	
E=	6.30775	F= 14.2996	G= 90.1982
BUCKEYE ROCKWELL T2C TRAINER/JAWAC			
LENGTH	38.3 FT	11.6738 M	
WEIGHT	13180 LB	5978.45 KG	5.88393 LT
SPEED	453 KT	233.204 M/S	765.117 F/S
POWER	0 HP	0 KW	
THRUST	5900 LB	26.2456 KN	
E=	2.2339	F= 21.7872	G= 48.6703

JQ1 - PATROL

U-2 LOCKHEED RECON/JWS 69-70  
 LENGTH 49.6 FT 15.1181 M  
 WEIGHT 17270 LB 7833.67 KG 7.70982 LT  
 SPEED 429 KT 220.849 M/S 724.581 F/S  
 POWER 0 HP 0 KW  
 THRUST 11000 LB 48.9324 KN  
 E= 1.57 F= 18.1309 G= 28.4654

P4M-1 MARTIN MERCATOR/JAWAC 51-52  
 LENGTH 85 FT 25.908 M  
 WEIGHT 80000 LB 36288 KG 35.7143 LT  
 SPEED 304 KT 156.499 M/S 513.456 F/S  
 POWER 5600 HP 4175.92 KW  
 THRUST 3000 LB 13.3452 KN  
 E= 8.8903 F= 9.81445 G= 87.2534

WB-57F CANBERRA PHOTO RECON/JFS/V PLUS  
 LENGTH 69 FT 21.0312 M  
 WEIGHT 50000 LB 22680 KG 22.3214 LT  
 SPEED 521 KT 268.211 M/S 879.969 F/S  
 POWER 0 HP 0 KW  
 THRUST 14400 LB 64.0569 KN  
 E= 3.47222 F= 18.6687 G= 64.822

P-2H LOCKHEED NEPTUNE/JWS  
 LENGTH 91.7 FT 27.9502 M  
 WEIGHT 80000 LB 36288 KG 35.7143 LT  
 SPEED 309 KT 159.073 M/S 521.901 F/S  
 POWER 7000 HP 5219.9 KW  
 THRUST 6800 LB 30.2491 KN  
 E= 5.64299 F= 9.60452 G= 54.1982

P-3C ORION/JWS  
 LENGTH 116.8 FT 35.6006 M  
 WEIGHT 135000 LB 61236 KG 60.2679 LT  
 SPEED 411 KT 211.583 M/S 694.179 F/S  
 POWER 19640 HP 14645.5 KW  
 THRUST 0 LB 0 KN  
 E= 8.67563 F= 11.3194 G= 98.2026

S-2E GRUMMAN TRACKER/JWS  
 LENGTH 43.5 FT 13.2588 M  
 WEIGHT 29150 LB 13222.4 KG 13.0134 LT  
 SPEED 230 KT 118.404 M/S 388.47 F/S  
 POWER 3050 HP 2274.39 KW  
 THRUST 0 LB 0 KN  
 E= 6.75046 F= 10.3797 G= 70.0678

S-3A LOCKHEED VIKING/JWS/V PLUS  
 LENGTH 53.3 FT 16.2458 M  
 WEIGHT 42500 LB 19278 KG 18.9732 LT  
 SPEED 430 KT 221.364 M/S 726.27 F/S  
 POWER 18550 HP 13832.7 KW  
 THRUST 0 LB 0 KN  
 E= 3.02538 F= 17.531 G= 53.038

E-1B		GRUMMAN TRACER/JWS	
LENGTH	43.5 FT	13.2588 M	
WEIGHT	26600 LB	12065.8 KG	11.875 LT
SPEED	207 KT	106.564 M/S	349.623 F/S
POWER	3050 HP	2274.39 KW	
THRUST	0 LB	0 KN	
E=	5.54395	F= 9.34173	G= 51.7901

E-2C		GRUMMAN HAWKEYE/JWS	
LENGTH	57.6 FT	17.5565 M	
WEIGHT	51569 LB	23391.7 KG	23.0219 LT
SPEED	325 KT	167.31 M/S	548.925 F/S
POWER	9820 HP	7322.77 KW	
THRUST	0 LB	0 KN	
E=	5.24116	F= 12.746	G= 66.8038

GULFSTREAM II		INACTIVE CG/VC-11A/JAWAC	
LENGTH	79.9 FT	24.3535 M	
WEIGHT	62000 LB	28123.2 KG	27.6786 LT
SPEED	511 KT	263.063 M/S	863.079 F/S
POWER	22800 HP	17002. KW	
THRUST	0 LB	0 KN	
E=	4.26722	F= 17.0157	G= 72.6096

FV-1		LOCKHEED VENTURA/JAWAC 45-46	
LENGTH	51.63 FT	15.7368 M	
WEIGHT	31000 LB	14061.6 KG	13.8393 LT
SPEED	260.5 KT	134.105 M/S	439.984 F/S
POWER	4000 HP	2982.8 KW	
THRUST	0 LB	0 KN	
E=	6.19978	F= 10.7909	G= 66.9013



# JQ2 - CARGO AIRPLANE

DHC-4		DEHAVILAND CARIBOU	
LENGTH	72.6 FT	22.1285 M	
WEIGHT	31300 LB	14197.7 KG	13.9732 LT
SPEED	158 KT	81.3384 M/S	266.862 F/S
POWER	2900 HP	2162.53 KW	
THRUST	0 LB	0 KN	
E=	5.23685	F= 5.51938	G= 28.9042

C-5A		LOCKHEED GALAXY	
LENGTH	247.8 FT	75.5294 M	
WEIGHT	769000 LB	348818. KG	343.304 LT
SPEED	496 KT	255.341 M/S	837.744 F/S
POWER	0 HP	0 KW	
THRUST	164000 LB	729.537 KN	
E=	4.68902	F= 9.37849	G= 43.9759

CL-44-6		CANADA	
LENGTH	136.7 FT	41.6662 M	
WEIGHT	205000 LB	92988 KG	91.5179 LT
SPEED	275 KT	141.57 M/S	464.475 F/S
POWER	22000 HP	16405.4 KW	
THRUST	0 LB	0 KN	
E=	7.8692	F= 7.00084	G= 55.091

C-46		CURTISS COMMANDO	
LENGTH	76.3 FT	23.2562 M	
WEIGHT	40000 LB	18144 KG	17.8571 LT
SPEED	191 KT	98.3268 M/S	322.599 F/S
POWER	4200 HP	3131.94 KW	
THRUST	0 LB	0 KN	
E=	5.58413	F= 6.50838	G= 36.3566

C-121G		SUPERCONSTELLATION	
LENGTH	113.6 FT	34.6253 M	
WEIGHT	133000 LB	60328.8 KG	59.375 LT
SPEED	291 KT	149.807 M/S	491.499 F/S
POWER	9200 HP	6860.44 KW	
THRUST	0 LB	0 KN	
E=	12.9188	F= 8.12654	G= 104.985

C-130H		COAST GUARD HERCULES	
LENGTH	98.75 FT	30.099 M	
WEIGHT	175000 LB	79380 KG	78.125 LT
SPEED	333 KT	171.428 M/S	562.437 F/S
POWER	18032 HP	13446.5 KW	
THRUST	0 LB	0 KN	
E=	9.92442	F= 9.97418	G= 98.988

C-130E		CARGO	
LENGTH	97.75 FT	29.7942 M	
WEIGHT	155000 LB	70308 KG	69.1964 LT
SPEED	368 KT	189.446 M/S	621.552 F/S
POWER	16200 HP	12080.3 KW	
THRUST	0 LB	0 KN	
E=	10.8126	F= 11.0788	G= 119.791

KC-135A		STRATOTANKER	
LENGTH	136.3 FT	41.5442 M	
WEIGHT	297000 LB	134719. KG	132.589 LT
SPEED	517 KT	266.152 M/S	873.213 F/S
POWER	0 HP	0 KW	
THRUST	55000 LB	244.662 KN	
E=	5.4	F= 13.1809	G= 71.1767

C-140A		JET STAR	
LENGTH	60.4 FT	18.4099 M	
WEIGHT	41000 LB	18597.6 KG	18.3036 LT
SPEED	550 KT	283.14 M/S	928.95 F/S
POWER	41000 HP	30573.7 KW	
THRUST	0 LB	0 KN	
E=	1.689	F= 21.0642	G= 35.5775

C-141A		STAR LIFTER	
LENGTH	145 FT	44.196 M	
WEIGHT	318000 LB	144245. KG	141.964 LT
SPEED	550 KT	283.14 M/S	928.95 F/S
POWER	0 HP	0 KW	
THRUST	84000 LB	373.665 KN	
E=	3.78571	F= 13.595	G= 51.4669

ARGUS CP-107		CANADAIR	
LENGTH	128.8 FT	39.2582 M	
WEIGHT	148000 LB	67132.8 KG	66.0714 LT
SPEED	274 KT	141.055 M/S	462.786 F/S
POWER	14800 HP	11036.4 KW	
THRUST	0 LB	0 KN	
E=	8.41429	F= 7.18612	G= 60.4661

# JQ3 - PASSENGER AIRPLANE

DC-3 DOUGLAS DAKOTA G47/JAWAC/ATVGD  
 LENGTH 64.5 FT 19.6596 M  
 WEIGHT 24800 LB 11249.3 KG 11.0714 LT  
 SPEED 200 KT 102.96 M/S 337.8 F/S  
 POWER 2100 HP 1565.97 KW  
 THRUST 0 LB 0 KN  
 E= 7.25319 F= 7.41228 G= 53.7627

DC-4 DOUGLAS SKYMASTER/JAWAC  
 LENGTH 92.25 FT 28.1178 M  
 WEIGHT 48000 LB 21772.8 KG 21.4286 LT  
 SPEED 225 KT 115.83 M/S 380.025 F/S  
 POWER 4200 HP 3131.94 KW  
 THRUST 0 LB 0 KN  
 E= 7.89662 F= 6.9727 G= 55.0608

DC-8 SUPER 62/MCDONNELL-DOUGLAS/JAWAC  
 LENGTH 157.4 FT 47.9755 M  
 WEIGHT 338000 LB 153317. KG 150.893 LT  
 SPEED 521 KT 268.211 M/S 879.969 F/S  
 POWER 0 HP 0 KW  
 THRUST 72000 LB 320.285 KN  
 E= 4.69444 F= 12.3605 G= 58.0258

DC-9 SER 20/MCDONNELL-DOUGLAS/JAWAC  
 LENGTH 104.4 FT 31.8211 M  
 WEIGHT 98000 LB 44452.8 KG 43.75 LT  
 SPEED 509 KT 262.033 M/S 859.701 F/S  
 POWER 0 HP 0 KW  
 THRUST 29000 LB 129.004 KN  
 E= 3.37931 F= 14.8275 G= 50.1069

DC-10 SER 30/MCDONNELL-DOUGLAS/JAWAC  
 LENGTH 182.4 FT 55.5955 M  
 WEIGHT 555000 LB 251748 KG 247.768 LT  
 SPEED 530 KT 272.844 M/S 895.17 F/S  
 POWER 0 HP 0 KW  
 THRUST 153000 LB 680.605 KN  
 E= 3.62745 F= 11.6806 G= 42.3708

BOEING 707 320B/JAWAC  
 LENGTH 152.9 FT 46.6039 M  
 WEIGHT 333600 LB 151321. KG 148.929 LT  
 SPEED 545 KT 280.566 M/S 920.505 F/S  
 POWER 0 HP 0 KW  
 THRUST 72000 LB 320.285 KN  
 E= 4.63333 F= 13.1188 G= 60.7838

BOEING 727 -100/ATVGD/JAWAC  
 LENGTH 133.1 FT 40.5689 M  
 WEIGHT 169000 LB 76658.4 KG 75.4464 LT  
 SPEED 549 KT 282.625 M/S 927.261 F/S  
 POWER 0 HP 0 KW  
 THRUST 43500 LB 193.505 KN  
 E= 3.88506 F= 14.164 G= 55.0278

BOEING 737 -200 ATVGD/JAWAC  
 LENGTH 100 FT 30.48 M  
 WEIGHT 115500 LB 52390.8 KG 51.5625 LT  
 SPEED 509 KT 262.033 M/S 859.701 F/S  
 POWER 0 HP 0 KW  
 THRUST 29000 LB 129.004 KN  
 E= 3.98276 F= 15.1502 G= 60.3397

BOEING 747 -200B/ATVGD/JAWAC  
 LENGTH 231.3 FT 70.5002 M  
 WEIGHT 775000 LB 351540 KG 345.982 LT  
 SPEED 528 KT 271.814 M/S 891.792 F/S  
 POWER 0 HP 0 KW  
 THRUST 187800 LB 835.409 KN  
 E= 4.12673 F= 10.3335 G= 42.6436

CONVAIR 880 GENL DYN/JAWAC  
 LENGTH 129.4 FT 39.4411 M  
 WEIGHT 193000 LB 87544.8 KG 86.1607 LT  
 SPEED 650 KT 334.62 M/S 1097.85 F/S  
 POWER 0 HP 0 KW  
 THRUST 44800 LB 199.288 KN  
 E= 4.30804 F= 17.0078 G= 73.2702

CONVAIR 990 GD/JAWAC  
 LENGTH 139.2 FT 42.4282 M  
 WEIGHT 255000 LB 115668 KG 113.839 LT  
 SPEED 650 KT 334.62 M/S 1097.85 F/S  
 POWER 0 HP 0 KW  
 THRUST 64400 LB 286.477 KN  
 E= 3.95963 F= 16.3982 G= 64.9307

CONVAIR 440 GD/JAWAC  
 LENGTH 81.5 FT 24.8412 M  
 WEIGHT 53194 LB 24128.8 KG 23.7473 LT  
 SPEED 252 KT 129.73 M/S 425.628 F/S  
 POWER 4800 HP 3579.36 KW  
 THRUST 0 LB 0 KN  
 E= 8.57608 F= 8.30852 G= 71.2545

L-1011-1 LOCKHEED/JAWAC  
 LENGTH 178.7 FT 54.4678 M  
 WEIGHT 430000 LB 195048 KG 191.964 LT  
 SPEED 530 KT 272.844 M/S 895.17 F/S  
 POWER 0 HP 0 KW  
 THRUST 126000 LB 560.498 KN  
 E= 3.4127 F= 11.8009 G= 40.2729

ELECTRA 188A/LOCKHEED/JAWAC  
 LENGTH 104.5 FT 31.8516 M  
 WEIGHT 113000 LB 51256.8 KG 50.4464 LT  
 SPEED 340 KT 175.032 M/S 574.26 F/S  
 POWER 18200 HP 13571.7 KW  
 THRUST 0 LB 0 KN  
 E= 6.48266 F= 9.89971 G= 64.1764

CARAVELLE 11R SUD AVN/JAWAC  
 LENGTH 105.1 FT 32.0345 M  
 WEIGHT 114640 LB 52000.7 KG 51.1786 LT  
 SPEED 434.5 KT 223.681 M/S 733.87 F/S  
 POWER 0 HP 0 KW  
 THRUST 28000 LB 124.555 KN  
 E= 4.09429 F= 12.6151 G= 51.6498

VISCOUNT VICKERS 700/JAWAC  
 LENGTH 81.2 FT 24.7498 M  
 WEIGHT 58500 LB 26535.6 KG 26.1161 LT  
 SPEED 279 KT 143.629 M/S 471.231 F/S  
 POWER 5600 HP 4175.92 KW  
 THRUST 365 LB 1.62367 KN  
 E= 8.47694 F= 9.21569 G= 78.1209

CONCORDE SER200/JAWAC  
 LENGTH 202.3 FT 61.661 M  
 WEIGHT 400580 LB 181703. KG 178.83 LT  
 SPEED 1260 KT 648.648 M/S 2128.14 F/S  
 POWER 0 HP 0 KW  
 THRUST 152200 LB 677.046 KN  
 E= 2.63193 F= 26.3678 G= 69.3983

# JQ4 - BOMBER

B-17 BOEING FLYING FORTRESS/JAWAC  
 LENGTH 74.75 FT 22.7838 M  
 WEIGHT 53000 LB 24040.8 KG 23.6607 LT  
 SPEED 275 KT 141.57 M/S 464.475 F/S  
 POWER 4800 HP 3579.36 KW  
 THRUST 0 LB 0 KN  
 E= 9.32469 F= 9.46736 G= 88.2802

B-29 BOEING SUPERFORTRESS/JAWAC  
 LENGTH 99 FT 30.1752 M  
 WEIGHT 14000 LB 6350.4 KG 6.25 LT  
 SPEED 305 KT 157.014 M/S 515.145 F/S  
 POWER 8800 HP 6562.16 KW  
 THRUST 0 LB 0 KN  
 E= 1.49009 F= 9.12397 G= 13.5955

B-25 NO AMER MITCHELL/JWS 69-70  
 LENGTH 52.9 FT 16.1239 M  
 WEIGHT 35000 LB 15876 KG 15.625 LT  
 SPEED 239 KT 123.037 M/S 403.671 F/S  
 POWER 3400 HP 2535.38 KW  
 THRUST 0 LB 0 KN  
 E= 7.55534 F= 9.78074 G= 73.8968

B-36 CONVAIR (43-44)/JWS/V PLUS  
 LENGTH 163 FT 49.6824 M  
 WEIGHT 357500 LB 162162 KG 159.598 LT  
 SPEED 378 KT 194.594 M/S 638.442 F/S  
 POWER 22800 HP 17002. KW  
 THRUST 20800 LB 92.5267 KN  
 E= 8.83992 F= 8.81251 G= 77.9019

B-47 BOEING STRATOJET/JAWAC 60-61  
 LENGTH 109.8 FT 33.467 M  
 WEIGHT 206260 LB 93559.5 KG 92.0804 LT  
 SPEED 547 KT 281.596 M/S 923.883 F/S  
 POWER 0 HP 0 KW  
 THRUST 36000 LB 160.142 KN  
 E= 5.72944 F= 15.5377 G= 89.0226

B-52G BOEING STRATO FORT/AV WK /V PLUS  
 LENGTH 157.6 FT 48.0365 M  
 WEIGHT 488000 LB 221357. KG 217.857 LT  
 SPEED 564 KT 290.347 M/S 952.596 F/S  
 POWER 0 HP 0 KW  
 THRUST 110000 LB 489.324 KN  
 E= 4.43636 F= 13.3722 G= 59.3239

B-52H BOEING STRATOFORT/JWS  
 LENGTH 156 FT 47.5488 M  
 WEIGHT 488000 LB 221357. KG 217.857 LT  
 SPEED 573 KT 294.98 M/S 967.797 F/S  
 POWER 0 HP 0 KW  
 THRUST 136000 LB 604.982 KN  
 E= 3.58824 F= 13.6551 G= 48.9976

B-57B MARTIN CANBERRA/JWS  
 LENGTH 65.5 FT 19.9644 M  
 WEIGHT 55000 LB 24948 KG 24.5536 LT  
 SPEED 505 KT 259.974 M/S 852.945 F/S  
 POWER 0 HP 0 KW  
 THRUST 14400 LB 64.0569 KN  
 E= 3.81944 F= 18.5726 G= 70.937

B-58 HUSTLER/JWS  
 LENGTH 96.75 FT 29.4894 M  
 WEIGHT 166208 LB 75391.9 KG 74.2 LT  
 SPEED 1198 KT 616.73 M/S 2023.42 F/S  
 POWER 0 HP 0 KW  
 THRUST 62400 LB 277.58 KN  
 E= 2.66359 F= 36.2521 G= 96.5607

B-66B DOUGLAS DESTROYER/JWS  
 LENGTH 75.2 FT 22.921 M  
 WEIGHT 95870 LB 43486.6 KG 42.7991 LT  
 SPEED 538 KT 276.962 M/S 908.682 F/S  
 POWER 0 HP 0 KW  
 THRUST 20400 LB 90.7473 KN  
 E= 4.69951 F= 18.4661 G= 86.7816

B-70 NO AMER VALKYRIE  
 LENGTH 189 FT 57.6072 M  
 WEIGHT 568300 LB 257781. KG 253.705 LT  
 SPEED 1635 KT 841.698 M/S 2761.51 F/S  
 POWER 0 HP 0 KW  
 THRUST 186000 LB 827.402 KN  
 E= 3.05538 F= 35.3988 G= 108.157

B-1\* DESIGN/AV WK/V PLUS  
 LENGTH 150 FT 45.72 M  
 WEIGHT 388000 LB 175997. KG 173.214 LT  
 SPEED 1090 KT 561.132 M/S 1841.01 F/S  
 POWER 0 HP 0 KW  
 THRUST 120000 LB 533.808 KN  
 E= 3.23333 F= 26.49 G= 85.6511

B-24 CONS VULTEE LIBERATOR/W PLUS  
 LENGTH 67.2 FT 20.4826 M  
 WEIGHT 60000 LB 27216 KG 26.7857 LT  
 SPEED 258 KT 132.818 M/S 435.762 F/S  
 POWER 4800 HP 3579.36 KW  
 THRUST 0 LB 0 KN  
 E= 9.90368 F= 9.36778 G= 92.7755

BEAGLE USSR BERIEV IL-28/JAWAC 59-60  
 LENGTH 62 FT 18.8976 M  
 WEIGHT 44000 LB 19958.4 KG 19.6429 LT  
 SPEED 504 KT 259.459 M/S 851.256 F/S  
 POWER 0 HP 0 KW  
 THRUST 11990 LB 53.3363 KN  
 E= 3.66972 F= 19.0518 G= 69.9149

BISON USSR MYASISHCHEV/JAWAC  
 LENGTH 162.4 FT 49.4995 M  
 WEIGHT 352750 LB 160007. KG 157.478 LT  
 SPEED 485 KT 249.678 M/S 819.165 F/S  
 POWER 0 HP 0 KW  
 THRUST 76760 LB 341.459 KN  
 E= 4.59549 F= 11.3279 G= 52.0574

BADGER USSR YUPOLEV TU-16/JAWAC  
 LENGTH 118 FT 35.9664 M  
 WEIGHT 175000 LB 79380 KG 78.125 LT  
 SPEED 510 KT 262.548 M/S 861.39 F/S  
 POWER 0 HP 0 KW  
 THRUST 41900 LB 186.388 KN  
 E= 4.17661 F= 13.9743 G= 58.3653

# JS1 - FIGHTER/INTERCEPTOR

P-39 BELL AEROCOBRA/JWS 69-70  
 LENGTH 29.75 FT 9.0678 M  
 WEIGHT 6000 LB 2721.6 KG 2.67857 LT  
 SPEED 348 KT 179.15 M/S 587.772 F/S  
 POWER 1000 HP 745.7 KW  
 THRUST 0 LB 0 KN  
 E= 6.41206 F= 18.9905 G= 121.768

P-38 LOCKHEED LIGHTNING/JAWAC 45-46  
 LENGTH 37.83 FT 11.5306 M  
 WEIGHT 15000 LB 6804 KG 6.69643 LT  
 SPEED 359.5 KT 185.071 M/S 607.195 F/S  
 POWER 3040 HP 2266.93 KW  
 THRUST 0 LB 0 KN  
 E= 5.44733 F= 17.3973 G= 94.7689

P-47 REPUBLIC THUNDERBOLT/JAWAC  
 LENGTH 36.1 FT 11.0033 M  
 WEIGHT 12500 LB 5670 KG 5.58036 LT  
 SPEED 382.1 KT 196.705 M/S 645.367 F/S  
 POWER 1625 HP 1211.76 KW  
 THRUST 0 LB 0 KN  
 E= 9.02611 F= 18.9289 G= 170.854

P51H NO AMER MUSTANG/JWS  
 LENGTH 32.3 FT 9.84504 M  
 WEIGHT 12100 LB 5488.56 KG 5.40179 LT  
 SPEED 423 KT 217.76 M/S 714.447 F/S  
 POWER 2218 HP 1653.96 KW  
 THRUST 0 LB 0 KN  
 E= 7.08649 F= 22.1534 G= 156.99

A3D DOUGLAS SKY WARRIER/JWS  
 LENGTH 76.3 FT 23.2562 M  
 WEIGHT 78175 LB 35460.2 KG 34.8996 LT  
 SPEED 547 KT 281.596 M/S 923.883 F/S  
 POWER 0 HP 0 KW  
 THRUST 21000 LB 93.4164 KN  
 E= 3.72262 F= 18.6392 G= 69.3866

A4M DOUGL SKY HAWK II/JWS  
 LENGTH 40.3 FT 12.2834 M  
 WEIGHT 24500 LB 11113.2 KG 10.9375 LT  
 SPEED 586 KT 301.673 M/S 989.754 F/S  
 POWER 0 HP 0 KW  
 THRUST 11200 LB 49.8221 KN  
 E= 2.1875 F= 27.4756 G= 60.1028

A6E GRUMMAN INTRUDER/JWS  
 LENGTH 54.6 FT 16.6421 M  
 WEIGHT 60400 LB 27397.4 KG 26.9643 LT  
 SPEED 563 KT 289.832 M/S 950.907 F/S  
 POWER 0 HP 0 KW  
 THRUST 18600 LB 82.7402 KN  
 E= 3.24731 F= 22.6785 G= 73.6441

A7 LOCKHEED CORSAIR II/JWS  
 LENGTH 46.1 FT 14.0513 M  
 WEIGHT 38200 LB 17327.5 KG 17.0536 LT  
 SPEED 606 KT 311.969 M/S 1023.53 F/S  
 POWER 0 HP 0 KW  
 THRUST 14250 LB 63.3897 KN  
 E= 2.6807 F= 26.5659 G= 71.2151

A-26 DOUGLAS INVADER/JAWAC  
 LENGTH 50.75 FT 15.4686 M  
 WEIGHT 32000 LB 14515.2 KG 14.2857 LT  
 SPEED 300 KT 154.44 M/S 506.7 F/S  
 POWER 4000 HP 2982.8 KW  
 THRUST 0 LB 0 KN  
 E= 7.37018 F= 12.5344 G= 92.3811

F4B MCDONNELL PHANTOM II/JWS  
 LENGTH 58.3 FT 17.7698 M  
 WEIGHT 54400 LB 24766.6 KG 24.375 LT  
 SPEED 1395 KT 718.146 M/S 2356.15 F/S  
 POWER 0 HP 0 KW  
 THRUST 34000 LB 151.246 KN  
 E= 1.60588 F= 54.3803 G= 87.3284

F5A NORTHROP FREEDOM FIGHTER/JWS  
 LENGTH 47.2 FT 14.3866 M  
 WEIGHT 20680 LB 9380.45 KG 9.23214 LT  
 SPEED 806 KT 414.929 M/S 1361.33 F/S  
 POWER 0 HP 0 KW  
 THRUST 8160 LB 36.2989 KN  
 E= 2.53431 F= 34.9193 G= 88.4965

F7U CHANCE VOUGHT CUTLASS/JAWAC 55-56  
 LENGTH 44.3 FT 13.5026 M  
 WEIGHT 31640 LB 14351.9 KG 14.125 LT  
 SPEED 565 KT 290.862 M/S 954.285 F/S  
 POWER 0 HP 0 KW  
 THRUST 48000 LB 213.523 KN  
 E= 0.659167 F= 25.2667 G= 16.655

F8-J LTV CRUSADER/JWS  
 LENGTH 54.5 FT 16.6116 M  
 WEIGHT 29500 LB 13381.2 KG 13.1696 LT  
 SPEED 1036 KT 533.333 M/S 1749.8 F/S  
 POWER 0 HP 0 KW  
 THRUST 19600 LB 87.1886 KN  
 E= 1.5051 F= 41.7699 G= 62.8679

F84F REPUBLIC THUNDERSTREAK/JWS  
 LENGTH 43.4 FT 13.2283 M  
 WEIGHT 28000 LB 12700.8 KG 12.5 LT  
 SPEED 603 KT 310.424 M/S 1018.47 F/S  
 POWER 0 HP 0 KW  
 THRUST 7220 LB 32.1174 KN  
 E= 3.87812 F= 27.2442 G= 105.656

F100D NO AMER SUPERSABRE/JWS  
 LENGTH 54.3 FT 16.5506 M  
 WEIGHT 34832 LB 15799.8 KG 15.55 LT  
 SPEED 748 KT 385.07 M/S 1263.37 F/S  
 POWER 0 HP 0 KW  
 THRUST 17000 LB 75.6228 KN  
 E= 2.04894 F= 30.2137 G= 61.906



F101B JWS  
 LENGTH 67 FT 20.4216 M  
 WEIGHT 51600 LB 23405.8 KG 23.0357 LT  
 SPEED 1060 KT 545.688 M/S 1790.34 F/S  
 POWER 0 HP 0 KW  
 THRUST 23400 LB 104.093 KN  
 E= 2.20513 F= 38.5452 G= 84.9971

F104C LOCKHEED STARFIGHTER/JWS  
 LENGTH 54.8 FT 16.703 M  
 WEIGHT 28660 LB 13000.2 KG 12.7946 LT  
 SPEED 1376 KT 708.365 M/S 2324.06 F/S  
 POWER 0 HP 0 KW  
 THRUST 17900 LB 79.6263 KN  
 E= 1.60112 F= 55.3261 G= 88.5835

F105D REPUBLIC THUNDERCHIEF/JWS  
 LENGTH 67 FT 20.4216 M  
 WEIGHT 52500 LB 23814 KG 23.4375 LT  
 SPEED 1208 KT 621.878 M/S 2040.31 F/S  
 POWER 0 HP 0 KW  
 THRUST 26500 LB 117.883 KN  
 E= 1.98113 F= 43.927 G= 87.0251

F111A/B JWS  
 LENGTH 73.5 FT 22.4028 M  
 WEIGHT 94200 LB 42729.1 KG 42.0536 LT  
 SPEED 1376 KT 708.365 M/S 2324.06 F/S  
 POWER 0 HP 0 KW  
 THRUST 41680 LB 185.409 KN  
 E= 2.26008 F= 47.7723 G= 107.969

F14A GRUMMAN TOMCAT/JWS  
 LENGTH 62 FT 18.8976 M  
 WEIGHT 72000 LB 32659.2 KG 32.1429 LT  
 SPEED 1346 KT 692.921 M/S 2273.39 F/S  
 POWER 0 HP 0 KW  
 THRUST 41800 LB 185.943 KN  
 E= 1.72249 F= 50.8804 G= 87.641

F15A MCDONNELL EAGLE/JWS  
 LENGTH 63.8 FT 19.4462 M  
 WEIGHT 40000 LB 18144 KG 17.8571 LT  
 SPEED 1432 KT 737.194 M/S 2418.65 F/S  
 POWER 0 HP 0 KW  
 THRUST 50000 LB 222.42 KN  
 E= 0.8 F= 53.3623 G= 42.6898

MIRAGE IV-A FRANCE DASSAULT/JWS  
 LENGTH 77.1 FT 23.5001 M  
 WEIGHT 69665 LB 31600. KG 31.1004 LT  
 SPEED 1266 KT 651.737 M/S 2138.27 F/S  
 POWER 0 HP 0 KW  
 THRUST 30600 LB 136.121 KN  
 E= 2.27663 F= 42.9149 G= 97.7015

MIG-15 USSR/JWS  
 LENGTH 36.4 FT 11.0947 M  
 WEIGHT 14350 LB 6509.16 KG 6.40625 LT  
 SPEED 578 KT 297.554 M/S 976.242 F/S  
 POWER 0 HP 0 KW  
 THRUST 6040 LB 26.8683 KN  
 E= 2.37583 F= 28.5154 G= 67.7476

MIG-23 USSR FOXBAT/JWS  
 LENGTH 69 FT 21.0312 M  
 WEIGHT 38000 LB 17236.8 KG 16.9643 LT  
 SPEED 1609 KT 828.313 M/S 2717.6 F/S  
 POWER 0 HP 0 KW  
 THRUST 24250 LB 107.874 KN  
 E= 1.56701 F= 57.6545 G= 90.3452

JS2 - RESEARCH

X-1 BELL/OAKES/GARBER/JAWAC 56-57  
 LENGTH 30.9 FT 9.41832 M  
 WEIGHT 12250 LB 5556.6 KG 5.46875 LT  
 SPEED 1433 KT 737.708 M/S 2420.34 F/S  
 POWER 0 HP 0 KW  
 THRUST 6000 LB 26.6904 KN  
 E= 2.04167 F= 76.7306 G= 156.658

X-15A NO AMER/JAWAC 63-64  
 LENGTH 50.75 FT 15.4686 M  
 WEIGHT 32900 LB 14923.4 KG 14.6875 LT  
 SPEED 3937 KT 2026.77 M/S 6649.59 F/S  
 POWER 0 HP 0 KW  
 THRUST 84320 LB 375.089 KN  
 E= 0.39018 F= 164.494 G= 64.1822

X-24B LIFT BODY  
 LENGTH 37.5 FT 11.43 M  
 WEIGHT 13000 LB 5896.8 KG 5.80357 LT  
 SPEED 868 KT 446.846 M/S 1466.05 F/S  
 POWER 0 HP 0 KW  
 THRUST 8000 LB 35.5872 KN  
 E= 1.625 F= 42.1896 G= 68.5582

SR 71A YF-12A/JAWAC  
 LENGTH 107.4 FT 32.7355 M  
 WEIGHT 170000 LB 77112 KG 75.8929 LT  
 SPEED 1798 KT 925.61 M/S 3036.82 F/S  
 POWER 0 HP 0 KW  
 THRUST 46000 LB 204.626 KN  
 E= 3.69565 F= 51.6404 G= 190.845

JY1 - SPACE

VANGUARD JAWAC 59-60  
 LENGTH 7.5 FT 2.286 M  
 WEIGHT 7333 LB 3326.25 KG 3.27366 LT  
 SPEED 4261 KT 2193.56 M/S 7196.83 F/S  
 POWER 0 HP 0 KW  
 THRUST 27000 LB 120.107 KN  
 E= 0.271593 F= 463.108 G= 125.777

SCOUT LTV/JAWAC 64-65  
 LENGTH 75.1 FT 22.8905 M  
 WEIGHT 47200 LB 21409.9 KG 21.0714 LT  
 SPEED 41990 KT 21616.5 M/S 70921.1 F/S  
 POWER 0 HP 0 KW  
 THRUST 107000 LB 475.979 KN  
 E= 0.441121 F= 1442.21 G= 636.189

JUNO JAWAC 61-62  
 LENGTH 12.1 FT 3.68808 M  
 WEIGHT 64000 LB 29030.4 KG 28.5714 LT  
 SPEED 43360 KT 22321.7 M/S 73235. F/S  
 POWER 0 HP 0 KW  
 THRUST 83000 LB 369.217 KN  
 E= 0.771084 F= 3710.21 G= 2860.88

GEMINI TITAN II MARTIN/JAWAC 64-65  
 LENGTH 19.8 FT 6.03504 M  
 WEIGHT 300000 LB 136080 KG 133.929 LT  
 SPEED 43100 KT 22187.9 M/S 72795.9 F/S  
 POWER 0 HP 0 KW  
 THRUST 430000 LB 1912.81 KN  
 E= 0.697674 F= 2883.01 G= 2011.4

SATURN V JAWAC  
 LENGTH 138 FT 42.0624 M  
 WEIGHT 6262500 LB 2840670 KG 2795.76 LT  
 SPEED 43100 KT 22187.9 M/S 72795.9 F/S  
 POWER 0 HP 0 KW  
 THRUST 7570000 LB 33674.4 KN  
 E= 0.827279 F= 1092.04 G= 903.423

THOR-AGENA DOUGLAS/JAWAC/V?  
 LENGTH 82 FT 24.9936 M  
 WEIGHT 123000 LB 55792.8 KG 54.9107 LT  
 SPEED 43100 KT 22187.9 M/S 72795.9 F/S  
 POWER 0 HP 0 KW  
 THRUST 170000 LB 756.228 KN  
 E= 0.723529 F= 1416.68 G= 1025.01

DELTA DOUGLAS DM-19/JAWAC/V?  
 LENGTH 92 FT 28.0416 M  
 WEIGHT 112000 LB 50803.2 KG 50 LT  
 SPEED 43100 KT 22187.9 M/S 72795.9 F/S  
 POWER 0 HP 0 KW  
 THRUST 150000 LB 667.26 KN  
 E= 0.746667 F= 1337.47 G= 998.647

ATLAS D GENL DYN/JAWAC/V?  
 LENGTH 82.5 FT 25.146 M  
 WEIGHT 265000 LB 120204 KG 118.304 LT  
 SPEED 43100 KT 22187.9 M/S 72795.9 F/S  
 POWER 0 HP 0 KW  
 THRUST 357000 LB 1588.08 KN  
 E= 0.742297 F= 1412.38 G= 1048.41

TITAN II MARTIN LGM-25C/JAWAC/V?  
 LENGTH 103 FT 31.3944 M  
 WEIGHT 330000 LB 149688 KG 147.321 LT  
 SPEED 43100 KT 22187.9 M/S 72795.9 F/S  
 POWER 0 HP 0 KW  
 THRUST 300000 LB 1334.52 KN  
 E= 1.1 F= 1264.04 G= 1390.44

A-80